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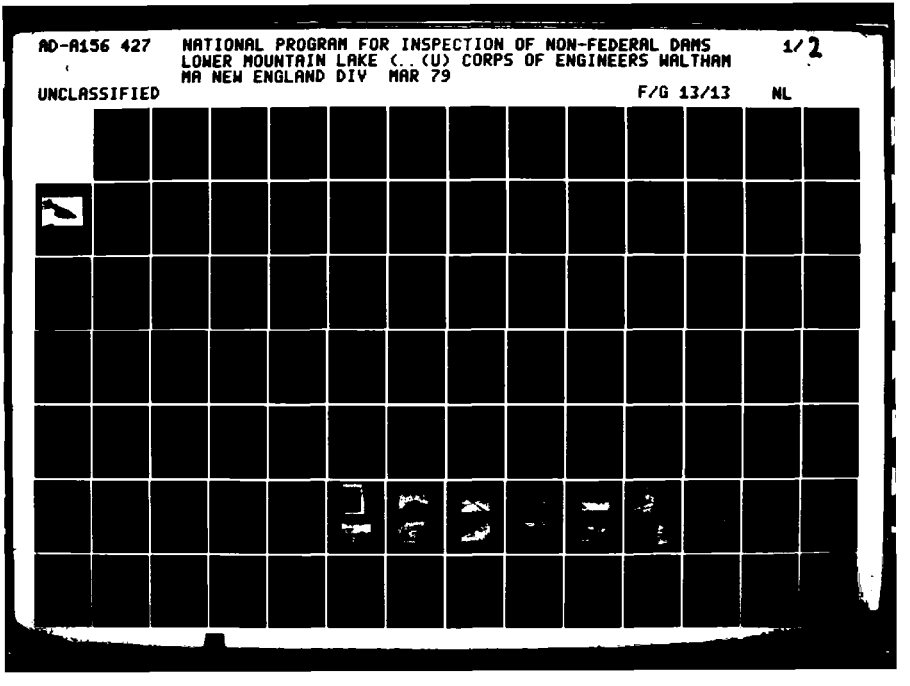

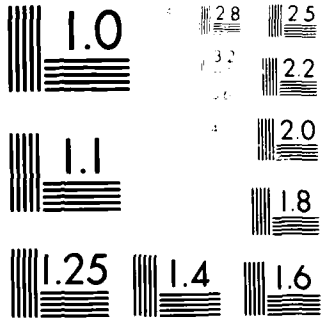

CONNECTICUT RIVER BASIN
HAVERHILL, NEW HAMPSHIRE

LOWER MOUNTAIN LAKE
N.H. 00195

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS 02154

MARCH 1979

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Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.

19 KEY WORDS (Continue on reverse side if necessary and identify by block number)

DAMS, INSPECTION, DAM SAFETY,

Connecticut River Basin
Haverhill, New Hampshire
Waterman Brook

20 ABSTRACT (Continue on reverse side if necessary and identify by block number)

The dam is an earth embankment structure with [illegible] and uncontrolled concrete [illegible] The dam is in [illegible] condition. The [illegible] are considered adequate. The [illegible] are considered adequate. The [illegible] are considered adequate. The [illegible] are considered adequate.

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DEPARTMENT OF THE ARMY

[illegible] CORPS OF ENGINEERS

424 TRAPELO ROAD

[illegible]

Dear Governor Gallen:

Inclosed is a copy of the Lower Mountain Lake Phase I Inspection Report, [illegible] prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Water Resources Board, the cooperating agency for the State of New Hampshire. In addition, a copy of the report has also been furnished the owner, Town & Country Homes, Inc., Haverhill, New Hampshire.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Water Resources Board for your cooperation in carrying out this program.

Sincerely,

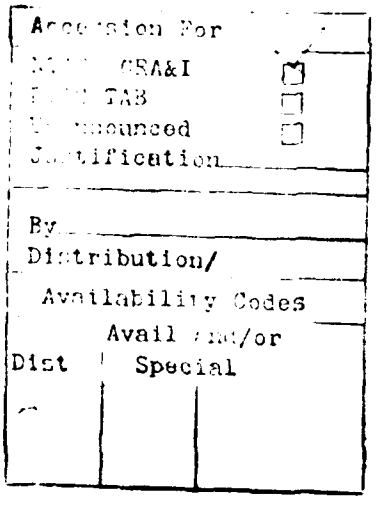
MAX B. SCHEIDER
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

LOWER MOUNTAIN LAKE

NH00195

HAVERHILL, NEW HAMPSHIRE



PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT

Identification No:	NH00195
Name of Dam:	Lower Mountain Lake
Town:	Haverhill
County and State:	Grafton County, New Hampshire
Stream:	Waterman Brook
Date of Inspection:	November 20, 1978

BRIEF ASSESSMENT

The Lower Mountain Lake Dam is an earth embankment structure with a continuous impervious earth core and cutoff trench. The dam is 960 feet long with a maximum height of 32.5 feet. Each face of the core wall is sloped at 1H:1V while the pervious upstream shell slopes at 3H:1V. The crest is 13 feet wide and the downstream face slopes at 2H:1V. There are three outlets including an 84-inch overflow pipe spillway, a 24-inch diameter low-level outlet conduit and an emergency spillway.

The dam was designed by the former engineering firm of Rollins, King and McKone Inc., of Manchester, New Hampshire; constructed in 1967 by Moulton Construction of Lebanon, New Hampshire.

Based on the small size and low hazard classification and in accordance with Corps guidelines, the test flood is the 100-year flood. The test flood inflow of 1,580 CFS (420 CSM) produces a routed test flood outflow of 1,242 CFS which overtops the emergency spillway by 2.2 feet. With water level at the top of the dam, the spillways will pass 1,765 CFS (469 CSM) which is 142 percent of the test flood.

The dam is in fair condition. Seepage was observed in five specific locations along the downstream toe of the dam. The following items require attention:

1. Riprap should be replaced where previously removed from the left side of the emergency spillway.

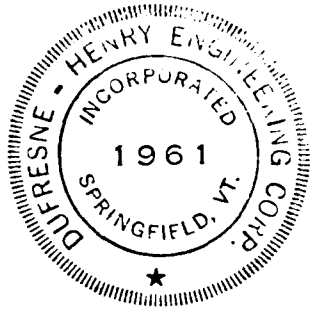
2. The in-place soil characteristics of the emergency spillway should be evaluated by a qualified engineer in order that erosion protection measures can be recommended if necessary.

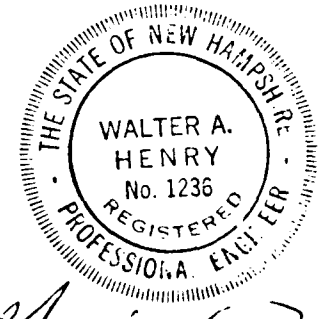
3. The method of operating the low-level discharge conduit is dangerous and undependable. A service pier should be constructed and the chain operated shear gate should be replaced by a stem operated gate valve.

4. The existing service bridge to the outlet spillway needs painting and the grating on the outlet riser pipe needs replacing.

5. A program of annual inspection should be implemented.

6. Flow characteristics and quantity should be measured and recorded in the area of the downstream low-level outlet conduit.





Walter A. Henry

This Phase I Inspection Report on Lower Mountain Lake Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

RICHARD DIBUONO, MEMBER
Water Control Branch
Engineering Division

ARAMAST MAHTESIAN, MEMBER
Geotechnical Engineering Branch
Engineering Division

CARNEY M. TERZIAN, CHAIRMAN
Design Branch
Engineering Division

APPROVAL RECOMMENDED:

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test Flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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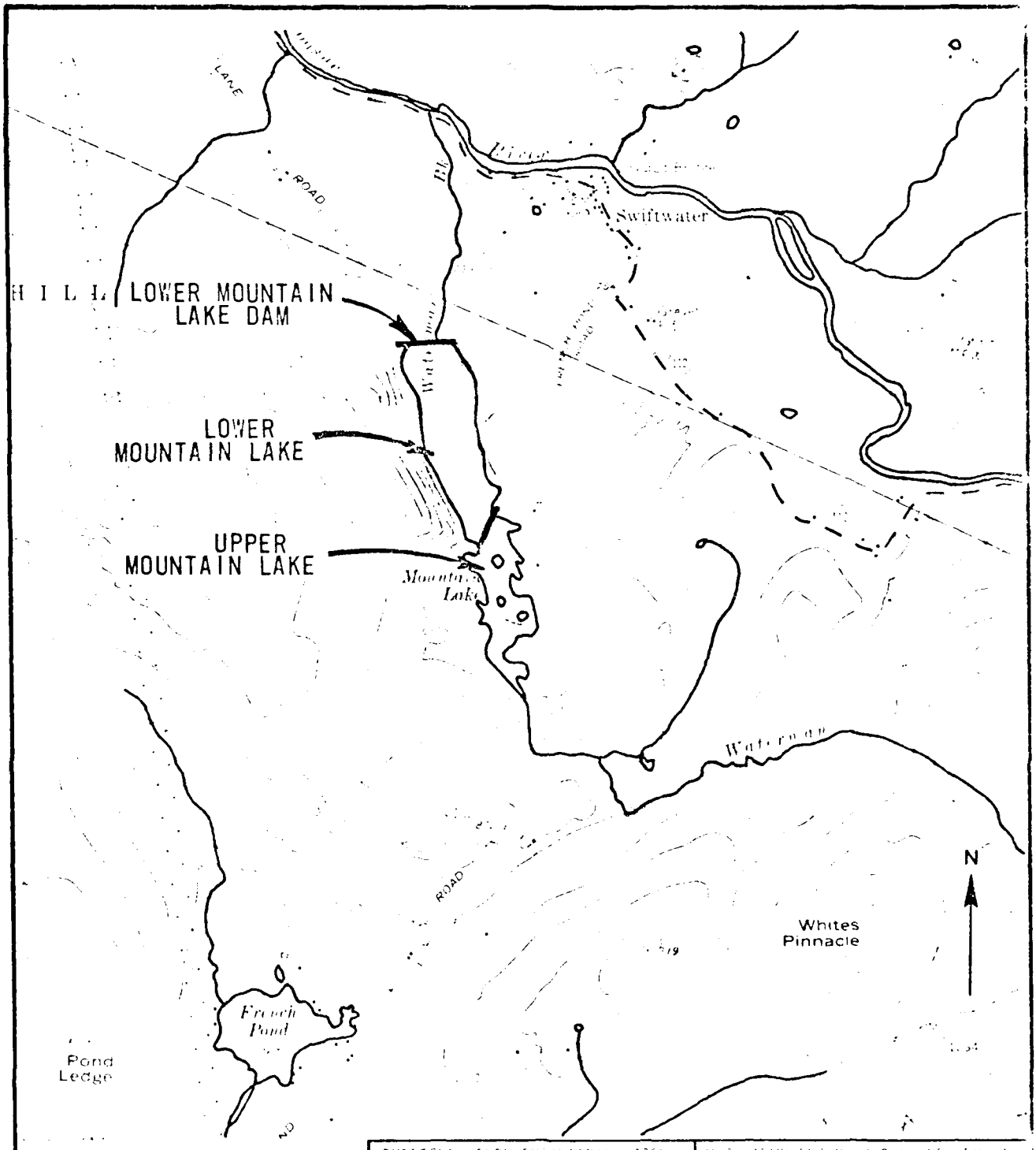
OVERVIEW OF

MOUNTAIN LAKE DAM

HAVERHILL, NEW HAMPSHIRE



SOURCE:
USGS QUADRANGLES
LISBON, N H 1967
EAST HAVERHILL, N H 1967
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DUFRESNE-HENRY ENGINEERING CORP.	U.S. ARMY ENGINEER DIV. NEW ENGLAN

NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS

LOCATION MAP
LOWER MOUNTAIN LAKE DAM

EAST MONTPELIER VERMONT

CLIENT NO.	04-0080	1"=2000'

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT
NAME OF DAM: LOWER MOUNTAIN LAKE

SECTION 1 - PROJECT INFORMATION

1.1 General

a. Authority

Public Law 92-367, August 8, 1972, authorized the Secretary of the Army through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Dufresne-Henry Engineering Corporation has been retained by the New England Division to inspect and report on selected dams in the State of New Hampshire. Authorization and notice to proceed were issued to Dufresne-Henry Engineering Corporation under a letter of November 20, 1978 from Max B. Scheider, Colonel, Corps of Engineers. Contract No. DACW33-79-C-0010 has been assigned by the Corps of Engineers for this work.

b. Purpose

(1) Perform technical inspection and evaluation of nonfederal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by nonfederal interests.

(2) Encourage and prepare the states to initiate quickly effective dam safety programs for nonfederal dams.

(3) To update, verify and complete the National Inventory of Dams.

1.2 Description of Project

a. Location

Lower Mountain Lake Dam is located in the Town of Haverhill, Grafton County, New Hampshire at 44° 07.1' north latitude and 71° 57.4' west longitude. The site is located on the Waterman Brook, a tributary of the Wild Ammonoosuc River, which drains into the Connecticut River. The dam is located approximately 3,600 feet upstream from the confluence of Waterman Brook and the Wild Ammonoosuc River.

b. Description of Dam and Appurtenances

The Lower Mountain Lake Dam is an earth embankment structure which, according to available drawings, has an impervious core and a cutoff trench (see Fiture 1, Appendix B). The overall length of the dam is 960 feet with a maximum height of 32.5 feet.

The emergency spillway (elevation 775.0) is 100 feet wide and is constructed on existing soil. The water surface was lowered during 1978 by constructing a trench in the emergency spillway for the purpose of bypassing the existing streambed so an infiltration gallery could be constructed.

There are two outlet conduits at Lower Mountain Lake. The normal outlet pipe is a 60-inch diameter corrugated metal pipe (invert elevation 755.7 MSL). This outlet is controlled by an 84-inch diameter riser at an overflow elevation of 774.0 feet MSL. The other outlet is a low-level outlet conduit at invert elevation 745.5 feet MSL. This conduit is controlled by a chain operated shear gate as shown in Figure 2, Appendix B.

The outlet channel is 35 feet wide with riprap protection. The surface level of the tailwater is held at a minimum elevation of 757 feet MSL by a gravel cofferdam. A system of infiltration galleries draws water from under the discharge channel as a public source of potable water.

Immediately upstream of this dam is the Upper Mountain Lake. The dam for this lake forms the upstream limits of the Lower Mountain Lake as shown in the Overview Photo.

c. Size Classification

The Lower Mountain Lake Dam has a size classification of small. The dam impounds about 44,000,000 cubic feet (1000 acre-feet) with a water surface at the dam crest elevation of 778.0. A dam with a maximum storage volume of 1000 acre-feet or less, or a height greater than 25 feet but less than 40 feet is classified as small. In this case, both criteria apply.

d. Hazard Classification

The potential for hazard in the event of failure of this dam is low. There are no homes in the areas affected by the flood wave.

e. Ownership

The dam is owned by the Town and Country Homes, Inc., a private entity. This dam is an integral part of a housing development in Haverhill, New Hampshire (see Photo 1, Appendix C).

f. Operator

Lower Mountain Lake Dam has no one individual responsible for the day-to-day operation of the dam. Mr. Robert Messini of Haverhill, New Hampshire (telephone 603-747-2606) handles the annual cleaning procedure and maintains impoundment levels.

g. Purpose of the Dam

The dam serves to impound water for recreation purposes such as fishing, boating and swimming. Also the impoundment provides stored water to increase yield for the public water supply immediately downstream of the dam.

h. Design and Construction History

The dam was designed by D. G. Blanchard, P.E. of the former Rollins, King & McKone, Inc., Manchester, New Hampshire. This design was reviewed and approved by the New Hampshire Water Resources Board. The two design drawings are contained in Appendix B, Figures 1 and 2. This information is in general agreement with observations made during the visual inspection.

The dam was constructed in 1967 by Moulton Construction of Lebanon, New Hampshire. Records of soils information taken during construction are included in Appendix B. As-built drawings are not available; however, based on visual inspection the dam doesn't seem to differ from the design drawings in Appendix B, Figures 1 and 2.

i. Normal Operational Procedures

Debris is annually removed from the pipe spillway and dam crest. The 6-inch diameter cold water outlet valve is operated during the summer months. Otherwise the dam, for all intents and purposes, is not operated.

1.3 Pertinent Data

a. Drainage Area

There is 3.76 square miles of drainage area at the Lower Mountain Lake Dam. The flow at this site is regulated by the Upper Mountain Lake Dam located immediately upstream of the dam. The drainage area is "long and narrow" (see Page vi) with moderate slopes of Class C forested soils. The Waterman Brook is the primary stream above the dam.

b. Discharge at Dam Site

(1) Outlet Works

The pipe spillway is designed for continuous overtopping and thus provides the major outlet at Lower Mountain Lake

Dam. The top of the controlling riser (84-inch diameter) is at elevation 774 feet MSL. The actual outlet is a 60-inch corrugated pipe at an invert elevation of 755.7.

The low-level outlet conduit is a 24-inch corrugated pipe at an invert elevation of 745.5 feet MSL.

The emergency spillway is 100 feet wide located in existing soil near the right side of the dam at elevation 775.0 feet MSL. The slope of the spillway is 0.5 percent in the flow direction.

(2) Maximum Known Flood at Dam Site

There are no records available regarding major flooding at the dam site. Mr. Messini, Operator, informed us that neither the emergency spillway nor the low-level outlet conduit have ever been utilized (except when the trench was cut into the emergency spillway).

(3) Ungated Spillway Capacity at Top of Dam

1325 CFS at 778.0 elevation.

(4) Ungated Spillway Capacity at Test Flood Elevation

835 CFS at 777.2 elevation.

(5) Gated Spillway Capacity at Normal Pool Elevation

Not applicable.

(6) Gated Spillway Capacity at Test Flood Elevation

Not applicable.

(7) Total Spillway Capacity at Test Flood Elevation

835 CFS at 777.2 elevation.

(8) Total Project Discharge at Test Flood Elevation

1242 CFS at 777.2 elevation.

c. Elevation Data

(1) Streambed at Centerline of Dam

744.0 feet above MSL.

(2) Maximum Tailwater

Not applicable.

(3) Upstream Portal Invert Diversion Tunnel

Not applicable.

(4) Recreation Pool (Normal)

774.0 feet above MSL.

(5) Full Flood Control Pool

Not applicable.

(6) Spillway Crest

775.0 feet above MSL.

(7) Design Surcharge (Original Design)

Unknown.

(8) Top Dam

778.0 feet above MSL.

(9) Test Flood Design Surcharge

777.2 feet above MSL.

d. Reservoir

(1) Length of Maximum Pool

5000 feet.

(2) Length of Recreation Pool

5000 feet.

(3) Length of Flood Control Pool

Not applicable.

e. Storage

(1) Recreation Pool (Normal Pool)

760 acre-feet.

(2) Flood Control Pool

Not applicable.

(3) Spillway Crest Pool

820 acre-feet.

(4) Top of Dam

1000 acre-feet.

(5) Test Flood Pool

952 acre-feet.

f. Reservoir Surface (Including Upper Mountain Lake)

(1) Recreation Pool (Normal Pool)

60 acres.

(2) Flood Control Pool

Not applicable.

(3) Spillway Crest

120 acres.

(4) Test Flood Pool

252 acres.

(5) Top Dam

300 acres.

g. Dam

(1) Type

Earth embankment.

(2) Length

960 feet.

(3) Height

Maximum height is 32.5 feet.

(4) Top Width

The top width is 12 feet.

(5) Side Slopes

Upstream - 3H:1V.

Downstream - 2H:1V.

(6) Zoning

Central core of "impervious fill," upstream and downstream shells.

(7) Impervious Core

Impervious earth core (Figure 2, Appendix B).

(8) Cutoff

Impervious earth trench (Figure 2, Appendix B).

(9) Grout Curtain

Not applicable.

(10) Other

Not applicable.

h. Diversion and Regulating Tunnel

Not applicable.

i. Spillway

Service Spillway

(1) Type

84-inch overflow pipe riser.

(2) Length of Weir

22 feet.

(3) Crest Elevation

774.0 feet above MSL.

(4) Gates

None

(5) Upstream Channel

Not applicable.

(6) Downstream Channel

Not applicable.

Emergency Spillway

(1) Type

Trapezoidal open channel.

(2) Length of Weir

100 feet.

(3) Crest Elevation

775.0 feet above MSL.

(7) General

Visual inspection indicates the spillway is functioning as designed.

j. Regulating Outlets

There are two regulating outlets at Lower Mountain Lake Dam. One outlet is a 6-inch diameter cast-iron gate valve at invert elevation 766. This outlet discharges into the 84-inch riser pipe spillway.

The other regulating outlet is a 24-inch diameter low-level discharge conduit at invert elevation 745.5. This conduit is a bituminous coated corrugated galvanized metal pipe controlled by a shear gate as shown in Figure 2, Appendix B.

SECTION 2 - ENGINEERING DATA

2.1 Design Data

The lower Mountain Lake Dam was designed in 1967 by Rollins, King and McKone, Inc., a former engineering firm of Manchester, New Hampshire. The design engineer for the dam, Donald G. Blanchard, P.E., can be contacted at New England College in Henniker, New Hampshire.

Copies of design drawings, approved by the New Hampshire Water Resources Board are contained in Appendix B, Figures 1 and 2.

The design drawings indicate the dam is an earth fill dam with an impervious earthen core and cutoff trench. The cutoff trench was designed to extend five feet into the natural impervious material underneath the entire dam. Downstream embankment slopes were designed at slope of 2H:1V and upstream slopes designed at 3H:1V.

The downstream porous shell was designed to be from 10 feet wide at the top to 40 feet wide at the base. In addition a 3-foot rock coarse gravel blanket was designed under the downstream shell along the entire dam. The core extends to elevation 776 or two feet above the natural pond level of 774. The core is 4 feet wide at the top and slopes down on both sides at 1H:1V.

The dam crest was designed to be 12 feet wide and to pitch down at a slope of 0.003 feet/foot toward both faces.

The emergency spillway was designed to be 100 feet long at the right abutment. The top of the spillway, at elevation 775.0 feet MSL, is designed into the natural soil, cut to an elevation of 774.5 feet MSL. Six inches of loam, seeded and mulched over the entire spillway, was placed on top of the natural ground. Riprap protection was designed along the downstream toe of the dam to limit erosion in the event of use of the emergency spillway.

There were two outlet conduits designed into the dam. An 84-inch diameter bituminous coated corrugated metal culvert (BCCMP) set 18 inches into a concrete pad forms a riser serving as outlet protection. The actual outlet conduit is a 60-inch BCCMP passing through the dam from the riser to a concrete headwall at the downstream toe of the dam. Also built into the riser is a cold water outlet conduit. The conduit is a 6-inch cast-iron pipe controlled by a gate valve set inside the riser. This outlet was required by the New Hampshire Fish and Game Department to supply a flow of cold water for the fish in the downstream channel.

The other outlet conduit was designed in the pre-dam stream channel (invert elevation 745.5 feet MSL). This low-level outlet pipe is a 24-inch diameter BCCMP passing through the dam. The downstream end of the culvert has some riprap protection.

Design calculations regarding the spillway and drainage basin hydraulics are available in Appendix B.

2.2 Construction Data

The dam was constructed between the months of May and July during 1968 by Moulton Construction of Lebanon, New Hampshire. The completed dam was inspected by the New Hampshire Water Resources Board in December 1968. The following items were noted as construction discrepancies from the design drawings and are repeated verbatim below:

1. Channel from principal spillway is 32 feet wide and not 40 feet wide as shown on the plan. However, as it carries only discharge from 60-inch culvert, it probably will cause no trouble.

2. Emergency spillway is 100 feet wide but the hillside edge of spillway is not on 100-foot radius but runs straight from pond. This may be a slight improvement.

3. Principal spillway discharge pipe is laid substantially to straight alignment.

4. There are many stumps in the pool area located several feet below normal full pond. These will undoubtedly cause problems around the principal spillway. However, they have an outer baffle two feet away from the principal spillway (ARMCO corrugated steel pipe - 7 feet in diameter). This baffle is 40 inches wide and extends about 12 inches below top of principal spillway and is ARMCO corrugated steel 11 feet in diameter. There are two 8-inch by 9-inch openings near the top of the baffle in one quadrant. From the top of the spillway to the top of baffle, there is quarter inch hardware cloth screening. No such screening covers the top of the spillway. At present there are about three 4-feet x 6-feet concrete form panels on top of the principal spillway.

Otherwise the dam appears to be constructed as designed.

Other construction information includes soils information tested during construction by Albert Goldberg and Associates, Inc. of Manchester, New Hampshire. This information is included in Appendix B.

2.3 Operation Data

The dam is basically not operated. The only operation which takes place is opening of the 6-inch cold water conduit valve. This valve allows continuous feed water to the infiltration galleries located in the downstream discharge channel. Other operational procedures are annual debris removal from the crest.

2.4 Evaluation of Data

a. Availability

The original design drawings and calculations are available for review from the New Hampshire Water Resources Board in Concord, New Hampshire.

b. Adequacy

The available engineering data are sufficient for the Phase I inspection.

c. Validity

The available engineering data are considered valid on the basis of the visual inspection with exceptions noted in 2.2.

SECTION 3 - VISUAL INSPECTION

3.1 Findings

a. General

Lower Mountain Lake Dam is in fair condition. Constructed in 1968, the dam has weathered eleven years with little evidence of deterioration.

b. Dam

The dam is an earth embankment dam with an earthen impervious core and cutoff trench. There is a pervious shell on the upstream (sloped at 3H:1V) and downstream (sloped at 2H:1V) sides.

The crest, shown in Photo 3, is about 12 feet wide and serves as an unrestricted travel way for vehicles. Generally the crest is in good condition, although there is some minor erosion in the vehicle tracks. The upstream face, shown in Photo 2, of the dam has riprap protection with 100-300 pound stones. The riprap on the upper 2 feet of the slope is partially covered with soil which appears to have been pushed down from the crest (see Photos 2 and 4).

The downstream slope, shown in Photo 9, has no visible discontinuities. There are some small pine trees 2 to 3 feet tall which are beginning to grow on the downstream face. Minor erosion has occurred in some areas and there are some vehicle tracks and footpaths across the slope.

Riprap protection with 300-100 pound stone is provided on the right side of the dam toe in order to prevent erosion from use of the low-level outlet conduit.

Some wet and seepage areas were observed in the vicinity of the downstream toe at the following locations beginning at the left abutment:

1. Fifteen feet to the left of the left end of the outlet structure wall. Some erosion was observed, but no water flow was apparent (see Photo 12).

2. At the right end of the outlet wall, water was observed dripping into the discharge channel (Photo 13).

3. Five feet to the right and 14 feet downstream of the right end of the outlet wall there was a minor seep.

4. A seepage area exists 150 feet to the right of the right end of the outlet structure wall and 30 feet downstream of the toe of the slope. The seepage zone begins at the location of the person shown in Photo 14 and extends downstream to the downstream channel. Iron staining and an oil-like water surface were evident.

5. Seepage was observed at the exit point of a 24-inch diameter pipe, approximately 210 feet right of the outlet-structure (Photos 15 and 16). Large stones up to 4 feet diameter existed around the pipe. As shown in Photo 17, some erosion was evident around the stones. Water was pooled around and downstream of the pipe and some flow was evident. Water has iron staining and oil-like surface appearance. The sound of dripping water was heard coming from inside the pipe.

At the downstream left side of the dam, there is an extensive wet area below the gravel road to the pump station (area is shown in Figure 1, Appendix C). This area appears saturated and cattails and dead hemlocks were noted. This inspection was not sufficient to determine whether the water originated in the reservoir or from the hillside directly above the area.

c. Appurtenant Structures

The outlet structure consists of an 84-inch diameter BCCMP embedded 18 inches into a 10-foot square concrete pad 36 inches deep. This vertical conduit forms a riser which protects the actual outlet pipe from debris. A steel screen fabricated over the top of the riser seems to be structurally unsafe due to corrosion. A 6-inch diameter cast-iron pipe passes through the vertical riser and functions as a cold water outlet pipe controlled by a gate valve. The actual outlet pipe consists of a 5-foot diameter BCCMP laid at a downstream slope of 1 percent. Two 10-foot by 10-foot steel diaphragms are imbedded into the impervious core to prevent flow outside the conduit. A concrete headwall is on the downstream end of the pipe.

Another outlet, the low-level outlet conduit, has been constructed in the predam stream channel. This pipe is a 24-inch BCCMP controlled by a shear gate at the upstream end of the conduit. The downstream end of the 24-inch pipe has been protected from wash with 500-1000 pound riprap. On the day of inspection the outlet conduit was discharging 5-7 GPM of rusty colored water which may be leaking past the shear gate.

The service bridge is embedded directly into the dam crest and extends to the top of the 84-inch riser as shown in Figures 4 and 5. Two 6-inch steel I-beams form the longitudinal

members and the decking is constructed with steel grating. Steel angles (2-inch by 2-inch) form railings. The entire structure is in need of painting.

The emergency spillway at Lower Mountain Lake has been constructed into natural material on the right end of the dam. The spillway appeared to have passed some flow prior to our inspection as shown in Photo 8. However, after discussions with Robert Messini, dam operator, it appears that the dam was lowered by constructing a trench in the spillway channel. The channel was then reworked to the condition shown in the photo. Also, as part of this work the riprap lining the left side of the spillway channel was removed. This riprap should be replaced.

d. Reservoir Area

The reservoir area of Lower Mountain Lake consists of 30 acres with the water level at elevation 774.0 feet MSL (top of riser). The combined reservoir area of Upper and Lower Mountain Lake is 60 acres at normal pool elevation.

e. Downstream Channel

The downstream channel consists of a natural streambed and is in good condition. There is no debris or overhanging vegetation in or near the channel. Directly below the dam, located in the discharge channel, is a system of infiltration galleries. This system withdraws water from under the discharge channel. A pump station to the right of the channel, directly below the dam, is used to transfer the water into a public water system. An adequate water level is maintained in the channel using a cofferdam as shown in Photo 7.

Further downstream the stream passes under the Lane Road and State Route 112 prior to joining the Wild Ammonoosuc River. There are no structures near the discharge channel prior to the confluence with the Wild Ammonoosuc.

3.2 Evaluation

Based on visual inspection, the dam appears to be in fair condition. Significant findings are as follows:

1. The small trees on the downstream slope could create a future seepage problem if they are allowed to grow without limit.

2. Trespassing on the slopes and the crest of the dam has produced minor local erosion.

3. Minor seepage was observed exiting downstream of the dam at several points. No evidence of soil transport was observed. The largest seep was next to a 24-inch pipe referred to in the drawings as "drain pipe" and which is a low-level outlet. This outlet is at the lowest point of the valley and thus the observed flow probably is due to the fact that this area corresponds also to the natural outlet for the blanket drain shown in the drawings.

4. The outlet structure appears to be functioning as designed. There was no debris near the outlet on the day of inspection.

5. Serious operating difficulties could be encountered in attempting to use the shear gate on the 24-inch drain pipe. The operator in attendance was not aware of the valve's existence or its operation. In addition to being easily forgotten should the dam change ownership, the valve could probably be closed only after the impoundment had been completely dewatered should this valve ever have to be opened.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 Procedures

The dam is not operated on a regular basis. No operational records exist.

4.2 Maintenance of the Dam

Little or no maintenance has been done on the dam or the appurtenant structures since construction. The grates over the 84-inch diameter riser should be replaced. The service bridge needs painting. Small trees growing on the slope should be cut.

4.3 Maintenance of the Operating Facilities

There is no maintenance provided.

4.4 Description of Any Warning System in Effect

There is no warning system in effect.

4.5 Evaluation

Semiannual cleaning of floatable debris in the impoundment should continue. The wet area below the 24-inch diameter low-level conduit should be checked periodically and flows recorded.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. General

The Lower Mountain Lake Dam is an earth embankment structure with a continuous impervious core wall and cutoff trench. The normal outlet structure is an 84-inch diameter pipe spillway; however, a 6-inch gate valve and/or a 24-inch low-level discharge conduit may be used to carry discharge as well as the emergency spillway.

b. Design Data

The spillway design flows were computed by the State of New Hampshire using the Kinnison-Colby formula. Their design computations for a 100-year flood had 222 CFS flowing through the riser and 678 CFS flowing over the emergency spillway for a total flood outflow of 900 CFS. Their computations are included in Appendix B.

c. Experience Data

There is no written record of overtopping at Lower Mountain Lake Dam. Mr. Robert Messini indicated the pipe spillway had handled all high flows since construction in 1968 without activating the emergency spillway. This indicates the Lake level has not risen above elevation 775.0.

d. Visual Observations

There was no evidence of overtopping at the Lower Mountain Lake Dam. The eroded area in the emergency spillway was described by Mr. Messini to have been disturbed by construction and not by high water levels.

e. Test Flood Analysis

Based on the U. S. Army Corps of Engineers criteria for a small, low-hazard dam, the 100-year frequency flood was selected as the test flood. Using the Soil Conservation Service engineering field manuals, the 100-year flood inflow is 1580 CFS (420 CSM). When routed through the Lower Mountain Lake Dam this results in a routed test flood outflow of 1242 CFS. At this flow the emergency spillway would be overtopped by 2.2 feet of water, but the water level would still be approximately .8 feet lower than the top of the dam.

f. Dam Failure Analysis

Upon dam failure under normal conditions with the water at elevation 774.0, a flow of approximately 13,000 CFS would result. However, under maximum water conditions with the level of water at elevation 778.0 a discharge of approximately 16,000 CFS would be released.

Either of these discharges pose no threat to human life as there are no homes near the channel downstream of the dam. Approximately .6 mile downstream the channel joins the Wild Ammonoosuc River, which would minimize the effects of a dam failure. The Wild Ammonoosuc River near Swiftwater, New Hampshire has a drainage of 57 square miles. The 100-year flood on this river would be approximately 20,000 CFS; hence the dam failure at Lower Mountain Lake would effectively create an event slightly less than a 100-year flood. There is little risk of damaging homes along the Wild Ammonoosuc as there is only one before this river reaches the Ammonoosuc. This home is judged to be about 30 feet above the river and is consequently safe from damage.

The only damage which may occur would be some erosion to New Hampshire State Route 112 as the flood wave could be two to three feet over the road in some low-lying locations.

SECTION 6 - STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

The visual inspection did not disclose any findings which would indicate instability of the foundation of the dam.

b. Design and Construction Data

Design Drawings Nos. 1 and 2 by Rollins, King and McKone, Inc., dated July 10, 1967, and revised May 5, 1968, (see Appendix B, Figures 1 and 2) were reviewed. The plans indicate that the dam was designed to have an impervious core, a cutoff trench extending down to impervious foundation material, and a horizontal coarse gravel drain blanket under the downstream shell of the dam. According to the plans, there is no exit pipe from the coarse gravel drain. Visual verification of these design features was not possible.

The left dike wall of the emergency spillway was constructed extending downstream perpendicular to the axis of the dam rather than curved, as shown on the design drawings. The left wall is also longer than as shown in the plans. Thus the emergency spillway discharge occurs farther downstream of the dam and consequently the riprap along the downstream toe of the dam was not placed.

c. Operating Records

There are no operating records.

d. Post-Construction Changes

There have been some past alterations performed at the emergency spillway which may warrant some additional study. A trench was dug into the emergency spillway in order to lower the dam below the outlet conduit. In addition, the riprap was removed from the left side of the spillway channel at the dam crest interface. If sufficient flows necessitated use of the spillway, these disturbed areas may erode.

e. Seismic Stability

The dam is in Seismic Zone 2 and in accordance with recommended Phase I guidelines does not warrant seismic analysis.

SECTION 7 - ASSESSMENT, RECOMMENDATIONS/ REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition

Lower Mountain Lake Dam is considered to be in fair condition. Visual inspection indicates the dam appears to be basically constructed as shown in the design drawings (Appendix B, Figures 1 and 2).

There were several seepage areas located on the downstream face of the dam. The upstream face appears adequately protected with riprap. The normal outlet structure appears to be in acceptable condition with minor repairs as described in Section 7.2.

b. Adequacy of Information

The data available were sufficient to adequately assess the dam and appurtenant structures for a Phase I Investigation. Visual inspection substantiates that the available information is indicative of actual conditions.

c. Urgency

The recommendations given in Section 7.2 should be carried out within one year after receipt of this report.

d. Need for Additional Investigation

As this dam is a small low-hazard dam in fair condition, additional investigations would not be recommended.

7.2 Recommendations

A professional engineer qualified in the design of dams should be engaged to assess the following items:

1. The method of operation of the low-level outlet conduit is not suitable. If the shear gate were ever activated, it may not reseat until the water level dropped the entire 30 feet to allow a manual reseating of the gate. With a public water source immediately downstream, it becomes particularly important to provide a better means of level control.

   a. The shear gate should be replaced with 24-inch cast-iron gate valves.

b. A service bridge or pier should be constructed to provide safe access to the gate valve.

2. The soils on the emergency spillway should be evaluated with respect to susceptibility to erode. This area has been disturbed by construction as described in Section 5.1.d. Based on this evaluation, specific protection recommendations could be formulated, if necessary.

7.3 Remedial Measures

a. Operation and Maintenance Procedures

The following items are recommended:

1. The small trees growing on the downstream face of the dam should be cut. This area as well as the dam crest should be kept free of such growth in the future.

2. The riprap which was removed from the left side of the emergency spillway should be replaced.

3. The flow exiting next to the 24-inch diameter low-level outlet conduit should be monitored and recorded on a bi-monthly basis.

4. A good grass cover should be maintained on the surface of the emergency spillway.

5. The dam and appurtenances should be inspected on an annual basis.

6. The existing service bridge to the outlet spillway needs painting and the grating on the outlet riser pipe needs replacing.

7.4 Alternatives

Not applicable.

APPENDIX A

VISUAL INSPECTION CHECK LIST

VISUAL INSPECTION CHECK LIST
PARTY ORGANIZATION

PROJECT LOWER MOUNTAIN LAKE DAM

DATE November 29, 1978

TIME 10:00 AM

WEATHER Cold, clear

W.S. ELEV. ____ U.S. ____ DN.S.

PARTY:

1. Robert E. Dufresne D-H
2. James H. Maynes D-H
3. Morris J. Root D-H
4. Ken Stern, New Hampshire Water Resources
5. ____
6. Steve [illegible] GEI
7. Gonzalo Castro GEI
8. ____
9. ____
10. ____

PROJECT FEATURE	INSPECTED BY	REMARKS
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

PERIODIC INSPECTION CHECK LIST

PROJECT LOWER MOUNTAIN LAKE DAM DATE November 20, 1975

PROJECT FEATURE _____ NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
DAM EMBANKMENT	
Crest Elevation	
Current Pool Elevation	
Maximum Impoundment to Date	Approximately one foot below level of emergency overflow elevation.
Surface Cracks	Not observed.
Pavement Condition	Not applicable.
Movement or Settlement of Crest	Not observed.
Lateral Movement	Not observed.
Vertical Alignment	Apparently some low spots along crest ($< .5'$).
Horizontal Alignment	Too irregular to judge
Condition at Abutment and at Concrete Structures	Erosion of soil at headwall on culvert downstream.
Indications of Movement of Structural Items on Slopes	Not applicable.
Trespassing on Slopes	Equipment tracks, bike paths observed.
Sloughing or Erosion of Slopes or Abutments	Minor downstream slope.
Rock Slope Protection - Riprap Failures	Riprap in good condition.
Unusual Movement or Cracking at or Near Toes	None observed.
Embankment or Downstream Seepage	Several locations described in text and located on plan (see Figure 1).
Piping or Boils	None observed.
Foundation Drainage Features	None known.
Toe Drains	Operating - apparently.
Instrumentation System	None.
Vegetation	Young pine trees growing.

PERIODIC INSPECTION CHECK LIST

PROJECT LOWER MORMAN LAKE DAM DATE November 3, 1976

PROJECT FEATURE _____ NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
OUTLET WORKS - CONTROL TOWER	
a. Structural	
General Condition	Good - CMP riser.
Condition of Joints	Not applicable.
Spalling	Not applicable.
Visible Reinforcing	Not applicable.
Rusting or Staining of Concrete	Not applicable.
Any Seepage or Efflorescence	Not applicable.
Joint Alignment	Not applicable.
Seepage or Leaks in Gate Chamber	Gate valve port open - not seated.
Cracks	Not applicable.
Rusting or Corrosion of Steel	Not applicable.
b. Mechanical and Electrical	
Air Vents	None.
Float Wells	None.
Crane Hoist	None.
Elevator	None.
Hydraulic System	None.
Service Gates	6" Gate valve - handle removed.
Emergency Gates	None.
Lightning Protection System	None.
Emergency Power System	None.
Wiring and Lighting System in Gate Chamber	None.

PERIODIC INSPECTION CHECK LIST

PROJECT LOWER MOUNTAIN LAKE DAM DATE November 20, 1979

PROJECT FEATURE _____ NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
OUTLET WORKS - TRANSITION AND CONDUIT	
General Condition of Concrete	Headwall good.
Rust or Staining on Concrete	None.
Spalling	None.
Erosion or Cavitation	None.
Cracking	None.
Alignment of Monoliths	Not applicable.
Alignment of Joints	Not applicable.
Numbering of Monoliths	Not applicable.

PERIODIC INSPECTION CHECK LIST

PROJECT LOWER MOUNTAIN LAKE DAM DATE November 20, 1978

PROJECT FEATURE _____ NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL	
General Condition of Concrete	Very good.
Rust or Staining	None.
Spalling	None.
Erosion or Cavitation	None.
Visible Reinforcing	None - tie rods forming.
Any Seepage or Efflorescence	Not applicable.
Condition at Joints	Not applicable.
Drain Holes	None.
Chanel	
Loose Rock or Trees Overhanging Channel	Some trees overhang channel.
Condition of Discharge Channel	Small gravel dam downstream with approximately 2 feet of water standing in impoundment which forms infiltration gallery to a municipal water supply.

PERIODIC INSPECTION CHECK LIST

PROJECT LOWER MOUNTAIN LAKE DAM DATE November 20, 1978

PROJECT FEATURE _____ NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
EMERGENCY SPILLWAY - SPILLWAY WEIR APPROACH AND DISCHARGE CHANNELS	
a. Approach Channel	Pond/lake (Upper Mountain Lake).
General Condition	
Loose Rock Overhanging Channel	
Trees Overhanging Channel	
Floor of Approach Channel	
b. Weir and Training Walls	None.
General Condition of Concrete	None.
Rust or Staining	None.
Spalling	None.
Any Visible Reinforcing	None.
Any Seepage or Efflorescence	None.
Drain Holes	None.
c. Discharge Channel	
General Condition	Apparent regrading on left side, removal of wall (riprap) to permit traffic on emergency spillway.
Loose Rock Overhanging Channel	None.
Trees Overhanging Channel	None.
Floor of Channel	Natural ground - disturbed by construction.
Other Obstructions	Relatively free of brush.

PERIODIC INSPECTION CHECK LIST

PROJECT LOWER MOUNTAIN LAKE DAM DATE November 10, 1978

PROJECT FEATURE _____ NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE	
a. Approach Channel	None
Slope Conditions	
Bottom Conditions	
Rock Slides or Falls	
Log Boom	
Debris	
Condition of Concrete Lining	
Drains or Weep Holes	
b. Intake Structure	5.0-foot diameter corrugated galvanized plate culvert set vertically, centered over outlet pipe.
Condition of Concrete	Top of culvert is fitted with steel grating. Entire structure was free of debris and in good condition
Stop Logs and Slots	

PERIODIC INSPECTION CHECK LIST

PROJECT LOWER MOUNTAIN LAKE DAM DATE November 20, 1979

PROJECT FEATURE _____ NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
OUTLET WORKS - SERVICE BRIDGE	
a. Super Structure	
Bearings	Not applicable.
Anchor Bolts	Not applicable.
Bridge Seat	Resting on corrugated culvert.
Longitudinal Members	6" I-beam paint is chipped.
Under Side of Deck	Steel grate.
Secondary Bracing	Not applicable.
Deck	Steel grate (18-inch catwalk) is serviceable.
Drainage System	Not applicable.
Railings	Angles 1-1/2" x 1-1/2" bolted into longitudinal members.
Expansion Joints	Not applicable.
Paint	Should be painted.
b. Abutments and Piers	Anchored into soil in dam crest.
General Condition of Concrete	Not applicable.
Alignment of Abutment	Not applicable.
Approach to Bridge	Dam crest.
Condition of Seat and Backwall	Not applicable.

PERIODIC INSPECTION CHECK LIST

PROJECT LOWER MOUNTAIN LAKE DAM DATE November 29, 1979

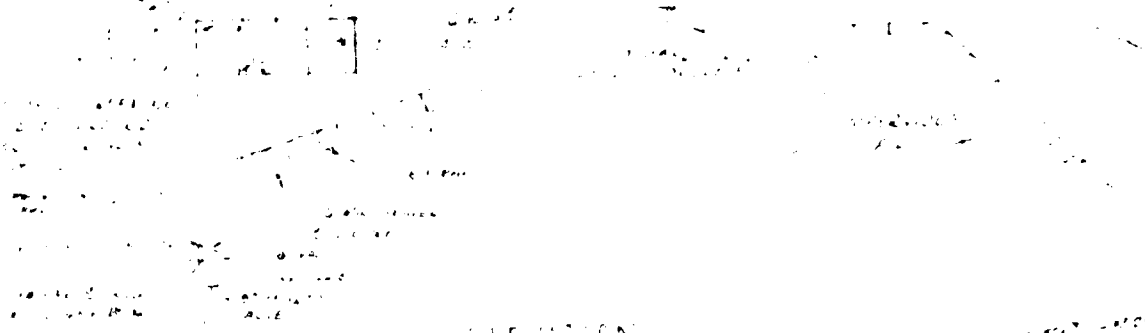
PROJECT FEATURE _____ NAME _____

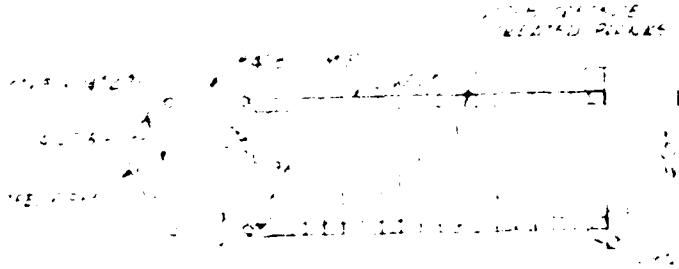
DISCIPLINE _____ NAME _____

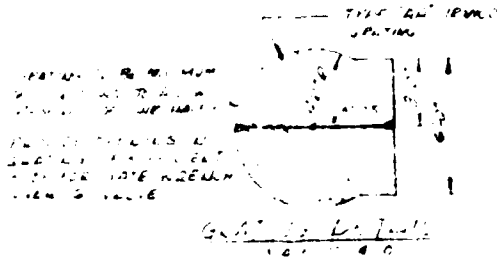
AREA EVALUATED	CONDITION
RESERVOIR	
Stability of Shoreline	Good. Riprap protection is adequate.
Sedimentation	Not apparent.
Changes in Watershed Runoff Potential	Minor development potential.
Upstream Hazards	1 House on upstream side of dam.
Downstream Hazards	Local road and state highway.
Alert Facilities	None.
Hydrometeorological Gages	None.
Operational and Maintenance Regulations	No written policy.
	a. Open valve when need water to maintain downstream flow for riparian owners.

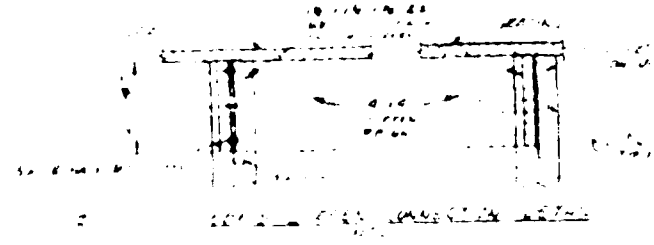
APPENDIX F

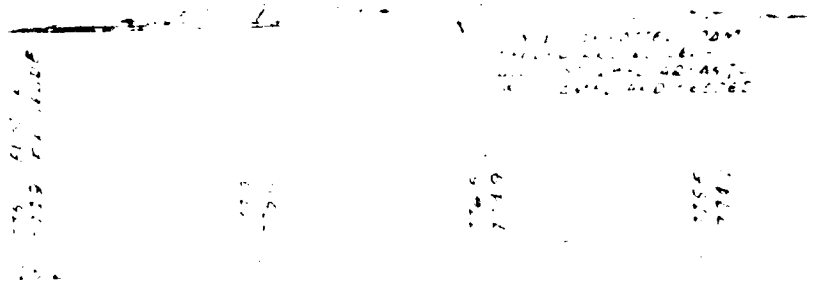
PROJECT RECORDS AND PLANS

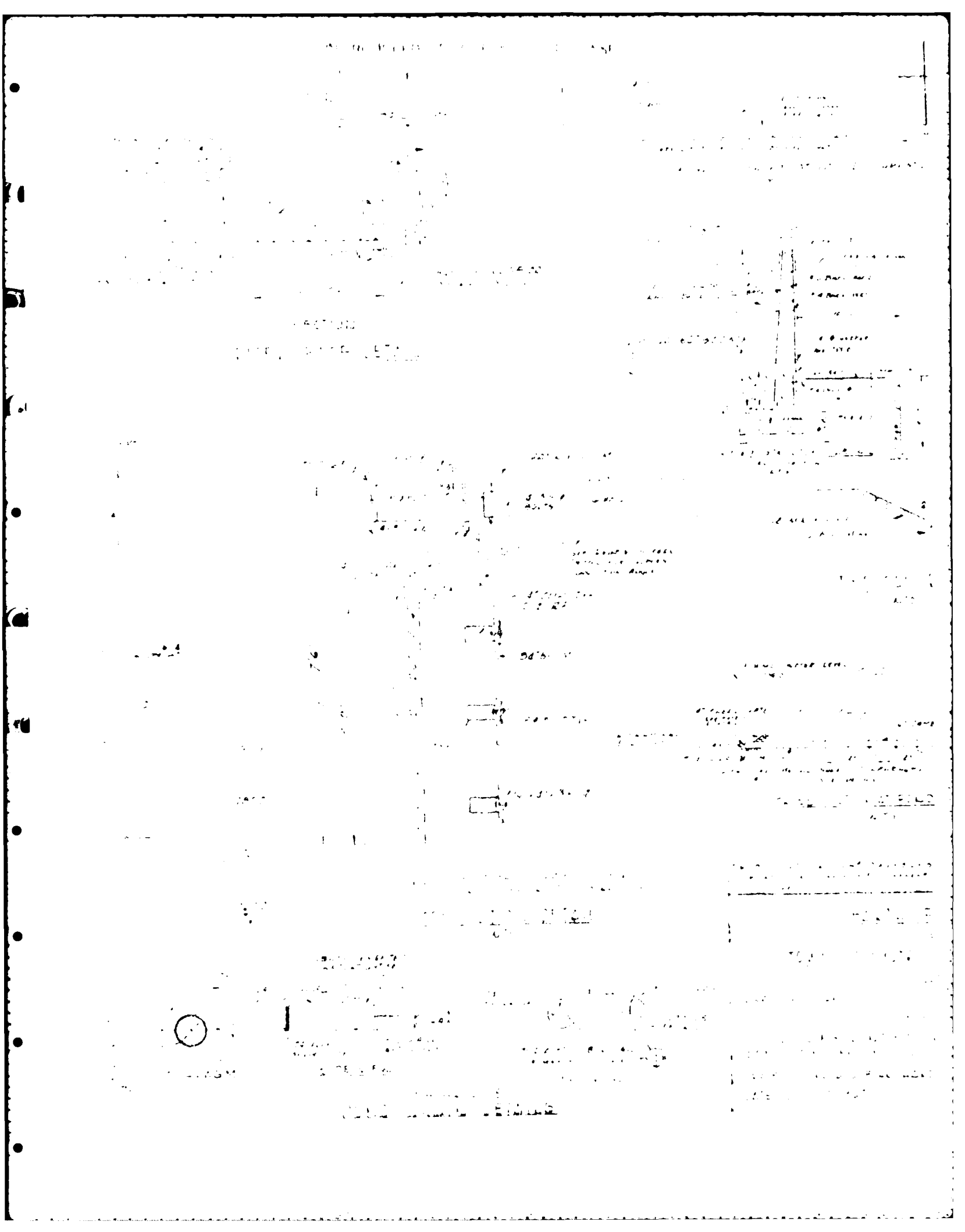


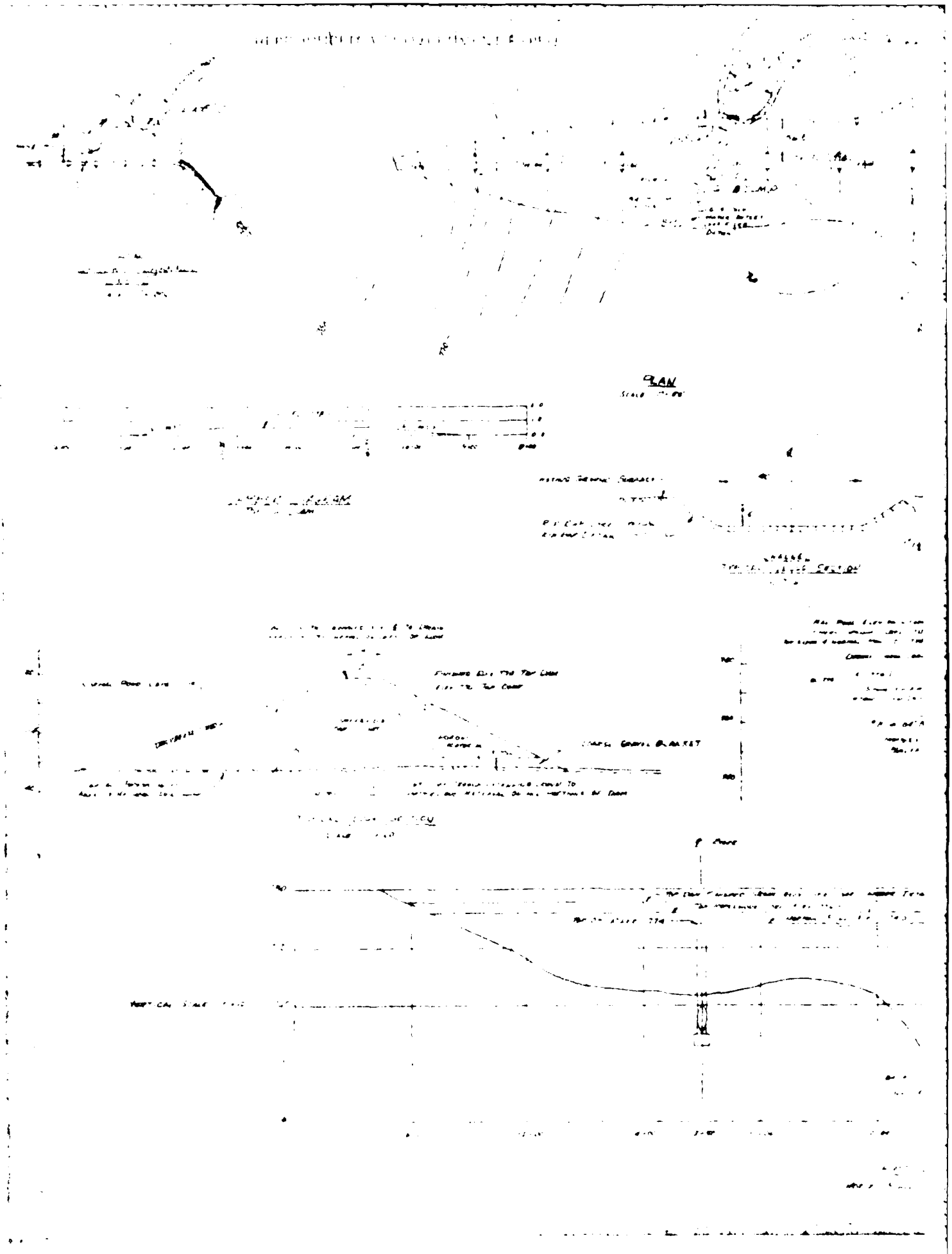


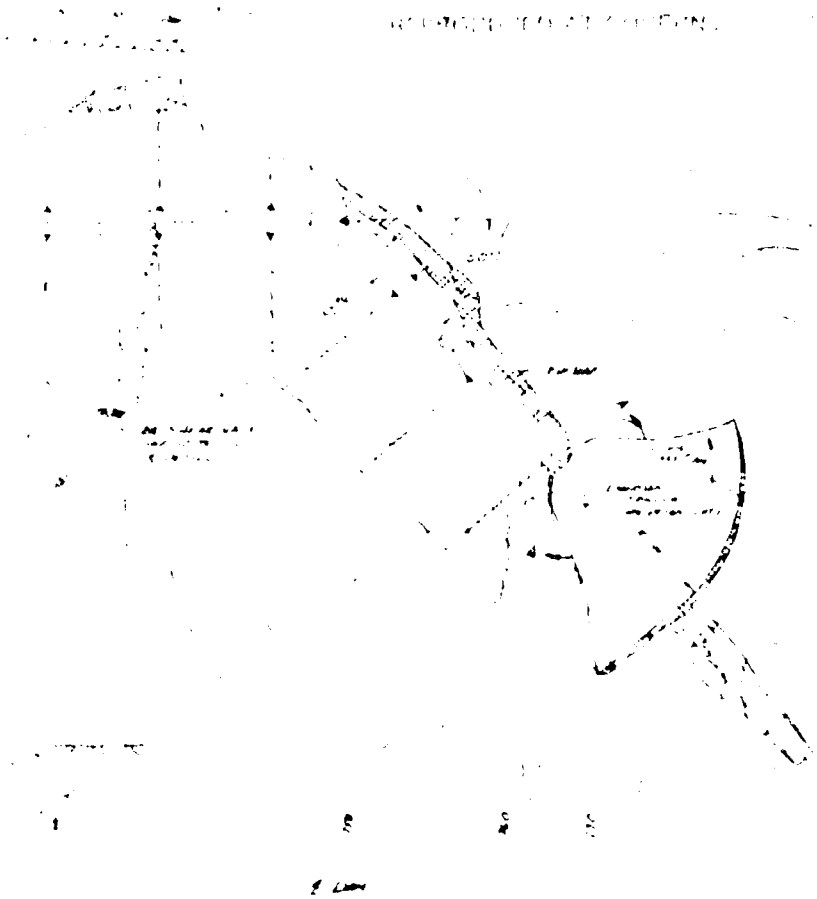


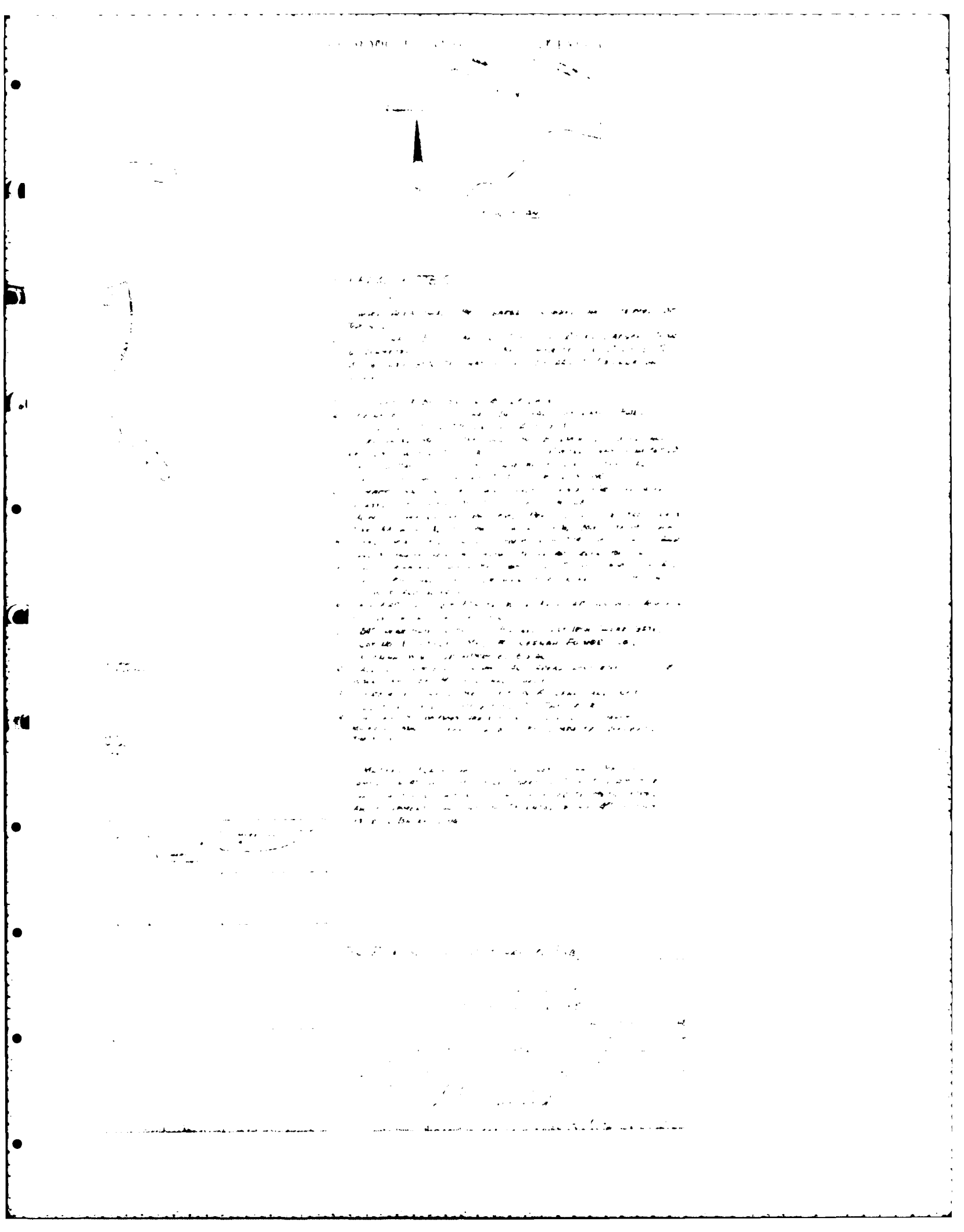







PLAN





March 8, 1967

Mr. Donald Blanchard
Foster Hill Road
Henniker, New Hampshire

Dear Don:

In reference to our conversation on March 6, 1967, I am enclosing the following data you requested on your Mountain Lake project:

1. Pond area (Proposed) — 30 Acres
2. Drainage Area — 3.74 sq. mi.
3. 15-year Frequency Storm — 310 cfs.
4. 100-year Frequency Storm — 900 cfs.

Due to the shape of this drainage area; long and narrow, the 15-year storm is not as large as I anticipated, usually 50% of the 100-year storm.

If you have any other questions regarding these flows, please let me know.

Very truly yours,

Vernon A. Knowlton
Civil Engineer

vak:c

SION ACC

COMPUTER CHECKER COST FROM ACC. COST ON ACC. SUMMARY ON ACC. DATE

Developed Area 3.74 Sq Miles = A

Basin Area 80 Acres = Use 5% = .0937

Average Slope (S) 420' = S

Average Travel L

1 Sq	X	4.5	4.50
1 Sq	X	3.5	3.50
.87	X	2.25	1.96
.87	X	.75	.65
3.74			10.61

$\frac{10.61}{3.74}$ = 2.84 Miles = L

$n^{.95}$ = 0.57237 × .95 = 25643 + 51559 = 0.54423 = .3501

$n^{.55}$ = 0.57237 × .55 = 28643 + 45829 = .48694 = .3069

$L^{0.7}$ = 045332 × .7 = 0.31732 = .

$L^{0.5}$ = " × .5 = 0.22665 = .

$S^{1.5}$ = 2.62325 = 3.93488 = 3.93

$S^{2.4}$ = " = 6.29585 = 1776

$15\%_{yr} = \left(.00000326 \, Q^{2.4} + 12.4\right) \frac{n^{.95}}{Q^{.24} \, L^{0.7}}$

$\left(3.26 \times 10^{-6} \times 1776 \times Q^{.24} + 12.4\right) \frac{.3501}{1.067 \times 2.076}$

$\frac{12.4}{71}$ (2.215)

$\frac{}{195}$ × .3501 = 56.777 ÷ 2.215 = 308 CFS = 305 CFS

$100\%_{yr} = \left(.03944 \, Q^{.15} + 2.01\right) \frac{n^{.95}}{L^{.5}}$

$\left(3.44 \times 10^{-4} \times 3267 \times Q^{.15} + 2.01\right) \frac{.3069}{1.685} = (1.821)$

296

200

.496 × 1.821 = 904 CFS

904 CFS

Wayne

Limit $\frac{S}{L} < \frac{1100}{\sqrt{A}}$

$\frac{325}{2.84} < \frac{1100}{\sqrt{3.74}}$

OK

Peterson 103

ACC.

COMPUTER PC HP CHECKED CONT. FROM ACC. CONT. ON ACC. SUMMARY ON ACC. DATE 7/25

Principal Spillway - No screens

6" Pipe I = 1.33

$3(20.56-2.7)^{\frac{3}{2}} - 3^{\frac{3}{2}}$, $3\sqrt{3} = Q = 222$ cfs.

$9(14.15) = 3$

$\frac{222}{12"\text{ pipe}} = \frac{222}{39.3} = 5.7$ sq. ft. - on vertical stack

"V" on horiz. pipe

$\frac{222}{6"\text{ pipe}} = \frac{222}{19.65} = 11.3$ "/sq. ft.

Using N = 0.021, w/18.8' head on 68' pipe - flow = 255 cfs.

Emergency Spillway: Need 678 cfs flow

Width = 100'

Load design = 75'

Effective width = 2.30

Coefficient = 3.055

Head = 2'

$678 \text{ cfs} / 100' = 6.78$ cfs/foot

$H = \left(\frac{6.78}{3.055}\right)^{\frac{2}{3}} = 1.815$

$H_p = 1.815 + 0.300 = 2.12'$

Av. Velocity = $\frac{6.78}{2.12} = 3.2$ '/sec.

If the 1"x2" mesh is used at principal spillway the width of emergency spillway must be increased from 100' to 140'. However it will mean the spillway may be operated nearly annually for considerable periods instead of for short times once in about two years.

At 1' head on princ. spillway, natural or emergency spillway the flow would be 50 cfs. or 15% of flow.

3 x 16.65 =

State of New Hampshire

WATER RESOURCES BOARD

37 Pleasant St.
CONCORD 03301

December 19, 1975

Town & Country Homes, Inc.
Mountain Lake
Haverhill, N. H.

Gentlemen:

Under the provisions of RSA-Chapter 482, Sections 8 through 15, the New Hampshire Water Resources Board is authorized to inspect all dams in the state which by reason of their physical condition, height, and location may be a menace to the public safety.

The dam structure (Dam # 112.12) located on your property in Haverhill, N.H. was inspected on 7-25-74 and as a result of this inspection no discrepancies were found at the time of the inspection which would require any corrective measures.

This letter is provided for your information only. If you have any questions, please feel free to call or write.

Sincerely,

George M. McGee, Sr.
Chairman

GMM/SCB:L

cc: Board of Selectmen
Haverhill, N.H.

N. H. WATER RESOURCES BOARD
Concord, N. H. 03301

DAM SAFETY INSPECTION REPORT FORM

Dam: Haven Hill Dam Number: 110.12

Inspected by: SCB Date: 25 July 1974

Local name of dam or water body:

Owner: Haven & Gately, Inc Address:

Owner was/was not interviewed during inspection.

Drainage Area: sq. mi. Stream:

Pond Area: 50.1 Acre, Storage Ac-Ft. Max. Head Ft.

Foundation: Type Earth, Seepage present at toe - Yes/No,

Spillway: Type Pipe & Emerg, Freeboard over perm. crest:

Width 10' 100', Flashboard height,

Max. Capacity c.f.s.

Embankment: Type Earth, Cover Grass Width 30,

Upstream slope 3 to 1; Downstream slope 2 to 1

Abutments: Type, Condition: Good, Fair, Poor

Gates or Pond Drain: Size 2' Steel Capacity Type Pipe

Lifting apparatus Operational condition Yes

Damage since construction or last inspection:

Downstream development: Haven Dam stream

This dam would/would not be a menace if it failed.

Suggested reinspection date:

Remarks: Good Shape

DATE: July 25, 1969

FROM: Robert W. Livingston
Water Resources Engineer

SUBJECT: Mountain Lake Dam #112.12 - Haverhill

TO: Vernon A. Knowlton
Chief Water Resources Engineer

Received a call from Charlie Barry, Fish and Game Conservation Officer of N. Haverhill (787-6212) that persons downstream of said dam were complaining that only a trickle of water was flowing.

Contacted Mr. MacDonald who operates dam for Town and Country. He said he would be in contact with Barry.

RWL/jb

Phone complaint 7/30/69 Walter Moran

#112.09

REAL ESTATE RESEARCH CORPORATION

July '66

Residential - Recreation Facility Complexes

1. Name of Development Mountain Lake

2. Location (community or nearest one and state) Bath, N. H.

3. Nearest Major Roadways (intersection) U.S. Rt. #302 at N.H. Rt. # 112
4 miles

4. Name, Address and Telephone Number of Developer Town & Country Homes, Inc., N. H. Highway Hotel, Concord, N. H. 224-7757

5. Size of Development 300 acres: 300 lots

6. Size of Lake: 35 acres

7. Other facilities (golf course, marina, shops, etc.)
Community Center and Bath House

8. Year of Initial Sales 1966

9. Number of Lots and Homes Sold:

0 lots: 0 HOMES

10. Are lots still being sold in the developments? yes, no X

Source:

Name Town & Country Homes, Inc. office

Address

*Please use a separate sheet for each project

DATE December 19, 1968

FROM Francis C. Moore FCM

SUBJECT Inspection of Mountain Pond, Haverhill (#112.12)

TO Vernon A. Knowlton

On December 17, 1968, I inspected the completed Mountain Pond Dam, Constructed by Moulton Construction Co. of Lebanon for Town and Country Homes, Inc. The following report is made based upon observations with 18" snow on the ground:

(1) Channel from principal spillway is 32' wide and not 40' wide as shown on the plan. However, as it carries only discharge from 60" culvert, it probably will cause no trouble.

(2) Emergency spillway is 100' wide but the hillside edge of spillway is not on 100' radius but runs straight from pond. This may be a slight improvement.

(3) Principal spillway discharge pipe is laid substantially to straight alignment.

(4) There are many stumps in the pool area located several feet below normal full pond. These will undoubtedly cause problems around the principal spillway. However, they have an outer baffle two feet away from the principal spillway (ARMCO corrugated steel pipe - 7' in diameter). This baffle is 40" wide and extends about 12" below top of principal spillway and is ARMCO corrugated steel 11' in diameter. There are two 8" X 8" openings near the top of baffle in one quadrant. From the top of spillway to top of baffle, there is quarter inch hardware cloth screening. No such screening covers the top of spillway. At present there are about three 4' X 6' concrete form panels on top of principal spillway.

Based upon ground conditions, it appears that this dam has been constructed essentially according to submitted specifications and with proper operation will create no menace.

FCM/jb

December 20, 1967

Town and Country Homes, Inc.
Highway Motel
Concord, New Hampshire

Dear Sir:

We are in recent receipt of soil analysis information on your proposed dam across Waterman Brook in Haverhill, New Hampshire.

Examination of the information submitted leads us to conclude that if this material is properly placed it should produce satisfactory results.

The conditions referred to in our August 18, 1967 letter of approval having now been met, you many commence construction on this structure at your convenience.

Very truly yours,

George M. McGee, Sr.
Chairman

GMcG/WK:pm

NAME: Rollins, King & McKone Sheet Number 1 of 1

JOB NO.: 26712 JOB NAME: Mountain Lake Dam DATE: Sept. 2

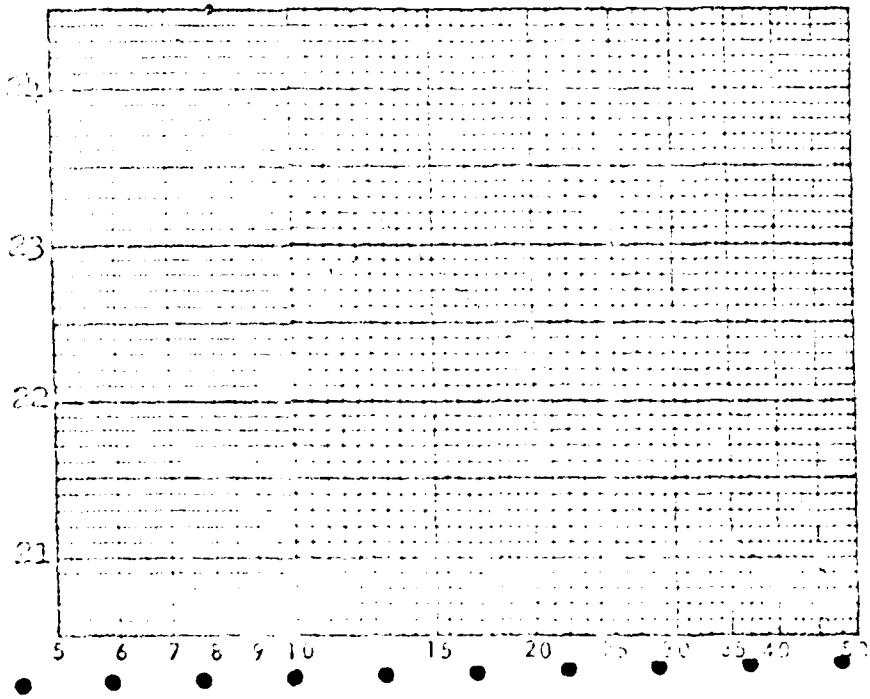
LIQUID AND PLASTIC LIMIT DETERMINATIONS DATA AND COMPUTATION SHEET

LL = LIQUID LIMIT TEST – %
PL = PLASTIC LIMIT TEST –
PI = PLASTICITY INDEX %
FI = FLOW INDEX – %
TI = TOUGHNESS INDEX – %

LIQUID LIMIT TEST	1	2	3	4	5	6
Boring Number						
Sample Number	#7	#7	#7			
Container Number	K-14	K-6	S-4			
Number of Blows	8	12	45			
Wt. Sample + Tare Wet	55.57	55.49	48.13			
Wt. Sample + Tare Dry	50.71	50.61	45.13			
Wt. of Water	4.86	4.87	3.00			
Tare	30.87	30.77	30.81			
Wt. of Dry Soil	19.84	20.04	14.32			
Water Content	24.5%	22.9%	20.9%			
Liquid Limit						

PLASTIC LIMIT TEST	1	2	3
Boring Number			
Sample Number			
Container Number	NOT OBTAINABLE		
Wt. Sample + Tare Wet			
Wt. Sample + Tare Dry			
Wt. of Water			
Tare			
Wt. of Dry Soil			
Water Content			
Plastic Limit			

FLOW CURVE



RESULTS

	1	2	3
LL	21.8%		
PL	---		
PI	---		
FI			
TI			

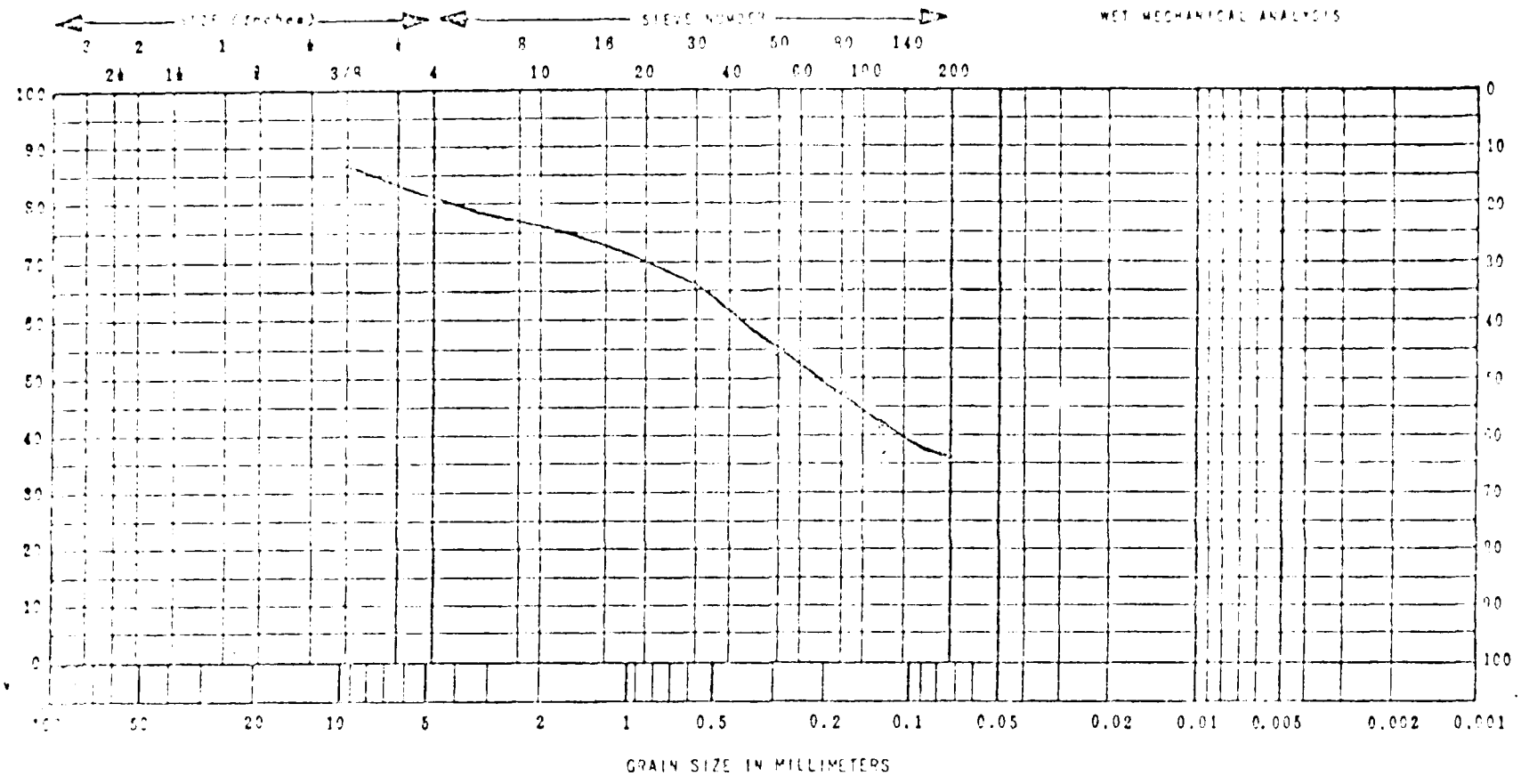
Remarks

GRAIN SIZE DISTRIBUTION GRAPH - AGGREGATE GRADING CHART

Sept. 20, 1967

Mountain Lake Dam

Sample No. 7



LOCATION NUMBER	SAMPLE NUMBER	NATURAL % MOISTURE	w_L	w_P	I_P	CLASSIFICATION	REMARKS

TESTED BY (Signature) | PLOTTED BY (Signature) | CHECKED BY (Signature)

E ANALYSIS
ATA AND COMPUTATION SHEET

BORING NO _____

T OF SAMPLE & TARE 1227.2 GM.

SAMPLE NO #7

HT OF TARE 221.5 GM. (TARE NO 2.12) DEPTH _____

T OF SAMPLE 1006.3 GM.

LOCATION _____

U. S. BUREAU OF STANDARDS SIEVE OPENINGS		SIEVE MESH	WEIGHT RETAINED IN GRAMS	PERCENT RETAINED	CUMULATIVE PERCENT FINER	REMARKS
INCHES	MILLIMETERS					
1.0000	25.400					
0.7500	19.100					
0.5000	12.700					
0.3750	9.520		134.2	13.3%	86.5%	
0.2500	6.350	3				
0.1870	4.760	4	59.7	5.9%	81.5%	
0.1320	3.360	6				
0.0937	2.380	8				
0.0787	2.000	10	62.0	6.2%	75.3%	
0.0661	1.680	12				
0.0469	1.190	16				
0.0331	0.840	20				
0.0232	0.590	30	100.1	9.9%	75.3%	
0.0165	0.420	40				
0.0117	0.297	50	100.1	10.0%	65.4%	
0.0083	0.250	60				
0.0059	0.210	70				
0.0041	0.177	80	72.5	7.2%	58.2%	
0.0029	0.149	100	59.2	5.9%	52.3%	
0.0021	0.074	200	60.2	6.0%	46.3%	
0.0021	0.053	270				
		PAN	350.0	34.8%	----	
PASSED		MESH SIEVE				
TOTAL			1006.3	100.0%		

SOIL COMPACTED IN MOLD @ 100% STANDARD PROCTER

DRY DENSITY = 120.6 #/FT³
WATER CONTENT = 8.25%

MOLD

DIAM = 10.16 cm
AREA = 81.1 cm²
HEIGHT = 11.63 cm

HEAD LOSS = 76.2 c

PERMEABILITY

TEST	TIME	QUANTITY	k
1	90 MIN.	30.4 c.c.	1.06×10^{-5}
2	75 MIN.	27.8 c.c.	1.11×10^{-5} c
3	150 MIN.	52.0 c.c.	1.09×10^{-5} c

Name: [illegible] Sample Identification: [illegible]

Date: [illegible] Sheet Number: [illegible]

STANDARD COMPACTION

25 blows on each of 3 layers with 5.0 -lb hammer, 12 -in drop.

Cylinder diameter (in.)		Initial wt. of soil, W_o (lbs.)	
" height (in.)		" water content, w_o	
" volume, V (in.^{3})		" wt. of solids, W_{so} (lbs.)	
" constant, C = 1/V	1/30	" " " water, W_{wo} (lbs.)	
Specific gravity of solids, S			

DATA FOR CURVES

Sample No.	1	2	3	4	5	6
Desired water content (%)						
Desired wt. of water (lbs.)						
Vol. of water added (c.c.)						
Wt. of cyl. + soil, W_t (lbs.)	12.40	12.50	12.70	12.74	12.87	12.82
" " " , W_c (lbs.)	6.45	6.45	6.45	6.45	6.45	6.45
" " soil, W_s (lbs.)	5.95	6.05	6.25	6.29	6.42	6.37
Average water content, w (%)	2.37	3.61	6.24	9.74	12.00	16.23
Point density, γ_m (lbs./ft.^{3})	132.1	132.5	137.5	138.7	142.6	139.4
Dry density, γ_d (dry) (lbs./ft.^{3})	129.1	127.8	129.8	126.3	127.6	119.9
Void ratio, e						
Degree of saturation, G (%)						
Sat. density, γ_m (sat.) (lbs./ft.^{3})						
" water content, w (sat.) (%)						

WATER CONTENTS

Sample No.		1	2	3	4	5	6
Container No.		C-13	K-24	F-13	D-4	P-26	C-20
Tare + wet soil	(grams)	87.43	73.38	76.04	93.10	88.62	92.7
" + dry "	(grams)	86.13	71.90	73.09	87.20	82.47	83.2
Wt. of water	(grams)	1.30	1.48	2.75	5.90	6.15	7.5
Tare	(grams)	30.80	30.31	30.27	37.31	30.91	30.9
Wt. of dry soil	(grams)	55.33	41.09	45.32	49.89	51.56	52.3
Water content, w	(%)	2.34	3.60	6.23	11.83	11.93	14.3
Container No.		K-16	C-20	F-20	[illegible]	[illegible]	[illegible]
Tare + wet soil	(grams)	77.27	63.32	73.69	75.57	90.30	107.0
" + dry "	(grams)	74.73	60.90	70.50	71.20	[illegible]	[illegible]
Wt. of water	(grams)	2.54	2.42	3.19	4.37	[illegible]	[illegible]
Tare	(grams)	30.43	30.60	30.32	32.77	[illegible]	[illegible]
[illegible]	(grams)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Name [illegible] Sheet Number 2

JOB NO.: 86722 JOB NAME: Mountain Lake Dam DATE: Sept

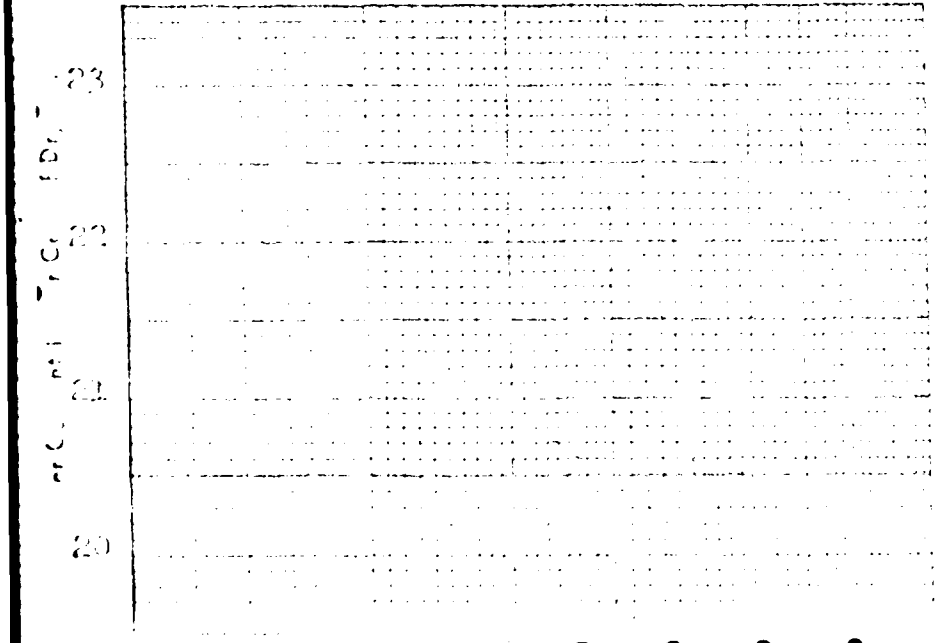
LIQUID AND PLASTIC LIMIT DETERMINATIONS
DATA AND COMPUTATION SHEET

LL = LIQUID LIMIT TEST
PL = PLASTIC LIMIT TE
PI = PLASTICITY INDE
FI = FLOW INDEX = S
TI = TOUGHNESS INDE

LIQUID LIMIT TEST	1	2	3	4	5	6
Boring Number						
Sample Number	#3	#3	#3			
Container Number	K-20	S-12	D-13			
Number of Blows	9	32	18			
Wt. Sample + Tare Wet	53.93	57.32	51.12			
Wt. Sample + Tare Dry	49.81	53.91	47.93			
Wt. of Water	4.12	3.41	3.41			
Tare	31.08	30.69	31.00			
Wt. of Dry Soil	18.73	23.22	16.93			
Water Content	21.9%	19.9%	20.3%			
Liquid Limit						

PLASTIC LIMIT TEST	1	2	3
Boring Number			
Sample Number			
Container Number	NOT OBTAINABLE		
Wt. Container + Tare Wet			
Wt. Sample + Tare Dry			
Wt. of Water			
Tare			
Wt. of Dry Soil			
Water Content			
Plastic Limit			

FLOW CURVE



RESULTS

	1	2	3
LL	20.1%		
PL	----		
PI	----		
FI			
TI			

DRY DENSITY IN lb/ft³
MAX DRY DENSITY = 120.0 lb/ft³
OPTIMUM WATER CONTENT = 8.25 %

NAME [illegible] DATE Sept. 20, 1967 JOB NO 66712

SIEVE ANALYSIS
DATA AND COMPUTATION SHEET
WT OF SAMPLE + TARE 1319.0 GM.

BORING NO
SAMPLE NO #3
DEPTH
LOCATION

WT OF TARE 371.5 GM. (TARE NO D-18)

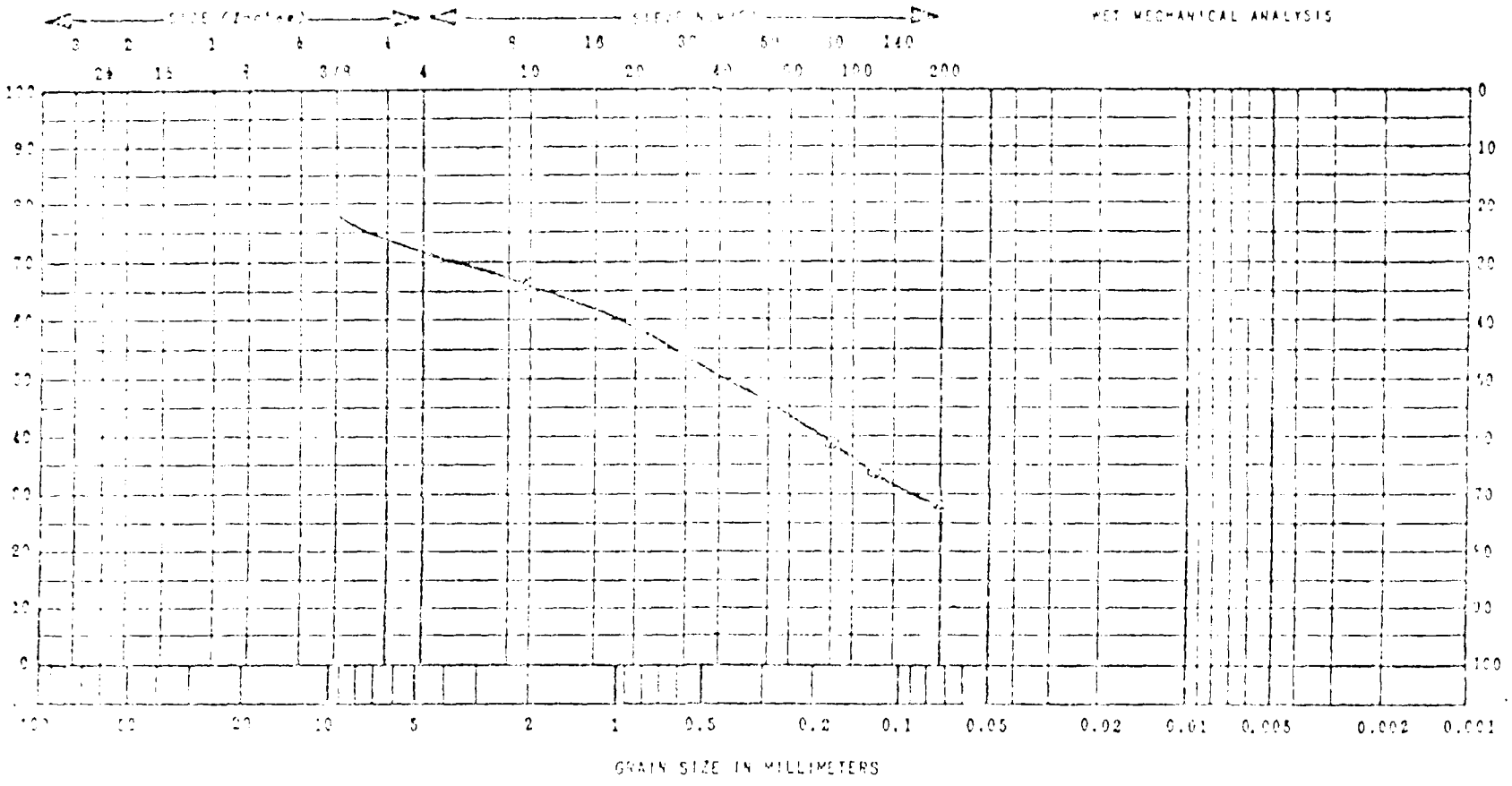
WT OF SAMPLE 947.5 GM.

U. S. BUREAU OF STANDARDS SIEVE OPENINGS			WEIGHT RETAINED IN GRAMS	PERCENT RETAINED	CUMULATIVE PERCENT FINER	REMARKS
INCHES	MILLIMETERS	SIEVE MESH				
1.0000	25.400					
0.7500	19.100					
0.5000	12.700					
0.3750	9.520		207.5	21.9%	78.1%	
0.2500	6.350	3				
0.1870	4.760	4	53.0	5.6%	72.5%	
0.1320	3.360	6				
0.0937	2.380	8				
0.0787	2.000	10	62.0	6.5%	66.0%	
0.0661	1.680	12				
0.0469	1.190	16				
0.0331	0.840	20				
0.0232	0.590	30	112.0	11.8%	54.2%	
0.0165	0.420	40				
0.0117	0.297	50	85.0	9.0%	45.2%	
0.0098	0.250	60				
0.0083	0.210	70				
[illegible]	[illegible]	100 [illegible]	61.0	6.4%	38.8%	
[illegible]	[illegible]	120 [illegible]	49.5	5.2%	33.6%	
0.0049	0.124	140	55.5	5.8%	27.7%	
0.0041	0.088	270				
		PAN	262.0	27.7%	------	
PASSED		MESH SIEVE				
[illegible]			[illegible]			

GRAIN SIZE DISTRIBUTION GRAPH - AGGREGATE GRADING CHART

DATE Sept. 20, 1957

Mountain Forks Dam — Sample No. 3



EXCAVATION NUMBER	SAMPLE NUMBER	NATURAL % MOISTURE	W_L	W_P	I_P	CLASSIFICATION	REMARKS

...ERT GOLDBERG AND ASSOCIATES, INC.
[illegible] • MANCHESTER, N.H. 03102 • (603) [illegible]
CONSULTING ENGINEE...

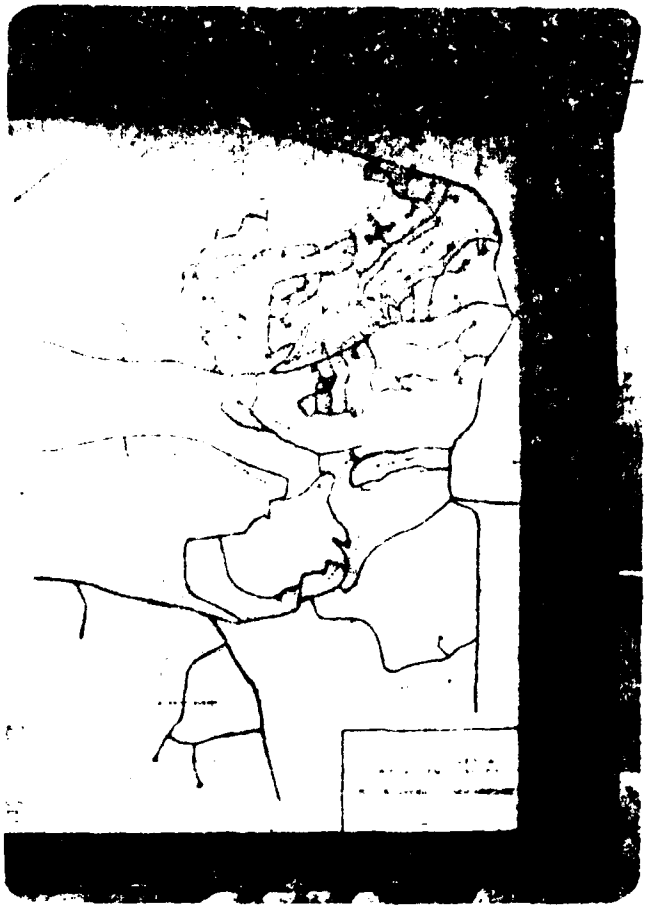
SUMMARY OF TEST RESULTS

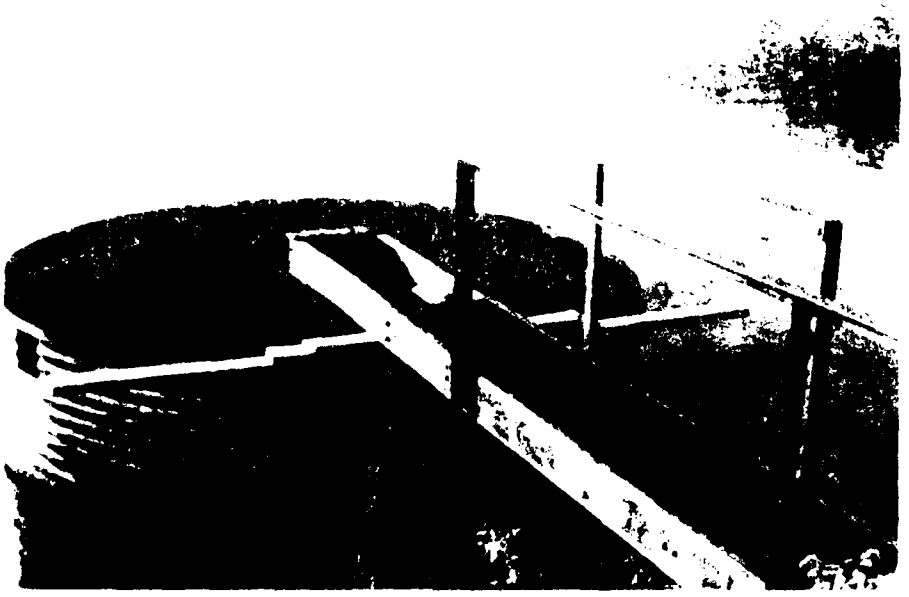
Test	Sample Number 3	Sample Number 7
Sieve	Passing 200 27.7%	Passing 200 42.0%
Liquid Limit	20.1%	21.8%
Plastic limit	NONE	NONE
Maximum Dry Density at Optimum Water Content	120.6 #/ft^3 8.2%	Not obtained
Permeability	Average of three tests = 1.09×10^{-5}	

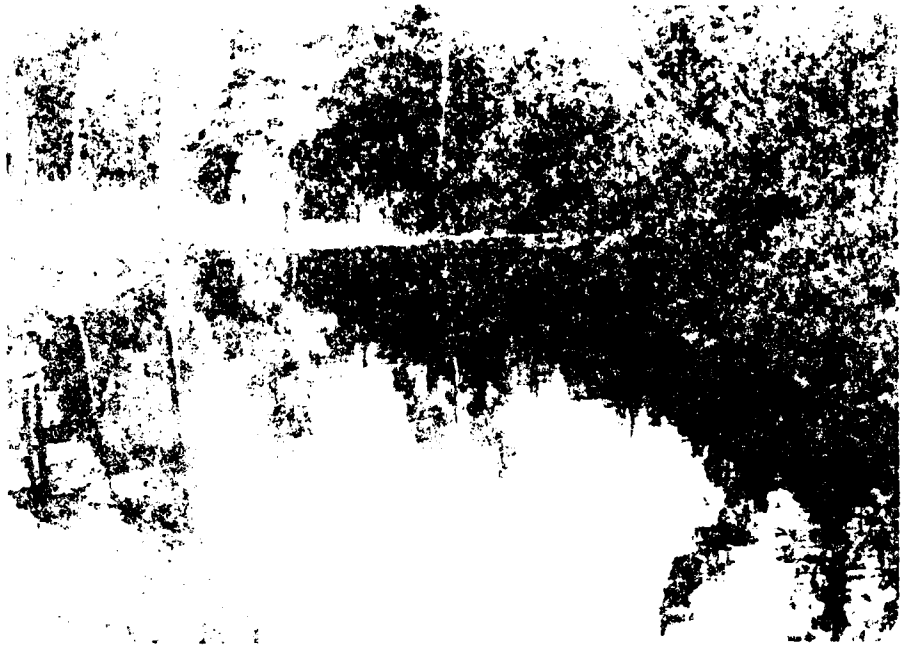
APPENDIX C

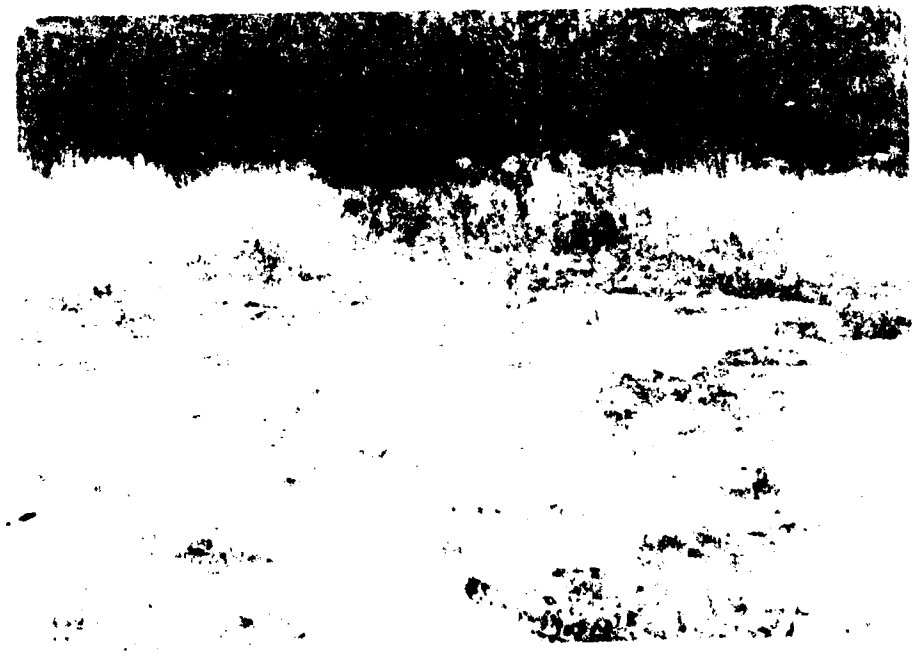
PHOTOGRAPHS

1. Identification Sign at Lake Site.
2. Dam Crest. Note Upstream Riprap and Right Dam Abutment.
3. Dam Crest. Note Access Road and Left Abutment.
4. Outlet Structure, Trash Guard and Service Bridge.
5. Service Bridge and Trash Guard.
6. Outlet Conduit Headwall.
7. Dam Outlet and Impoundment Near Infiltration Lines.
8. Emergency Spillway Area. Note Washed Area.
9. View of Downstream Slope of Dam. Note Initial Stages of Forestation.
10. Seep Noted on Downstream Toe Location Described in Figure 1.
11. Pump Station Located Downstream of the Dam.
12. Seepage Zone 15 Feet Left of Left Outlet Structure Wall.
13. Seepage Zone at End of Right Outlet Structure Wall.
14. High Natural Ground and Seepage Zone 30 Feet Downstream of Downstream Toe (Seepage Area is Near Person.)
15. Seepage Around and From 24-Inch Low-Level Outlet. Note Iron Staining and Oil-Like Surface.
16. Seepage Around and From 24-Inch Diameter Pipe.
17. Close-up of Erosion Around Large Stones Placed Around Exit Pipe.









APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

DUFRESNE-HENRY ENGINEERING CORPORATION

BY _____ SUBJECT _____ SHEET NO _____ OF _____

DATE _____ JOB NO _____

DUFRESNE-HENRY ENGINEERING CORPORATION

BY _____ SUBJECT _____ SHEET NO. _____ OF _____

DATE _____ JOB NO. _____

FROM EXPLORATION SOIL TYPES = PREDOMINANTLY THE FINE
MEDIUM SAND IS OF THE CLASS 'SC' MEDIUM SOIL CLASS.

LAND USE = RESIDENTIAL

SLOPE = MODERATE

[illegible] FOR [illegible] SOIL Runoff Curve No. = 73

U.S.D.A. ENGINEERING FIELD MANUAL

100 YR - 24 HOUR RAINFALL = 6.0"

[illegible] USING [illegible]

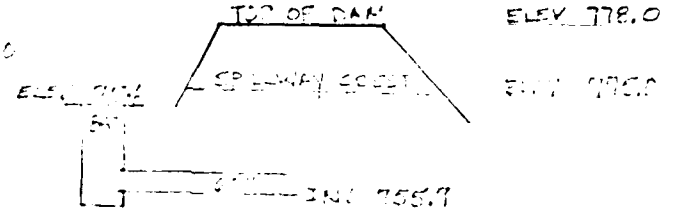
[illegible]

THIS FLOW IS NOT USED IN THE [illegible] FOR A
SMALL [illegible] BASIN.

DUFRESNE-HENRY ENGINEERING CORPORATION

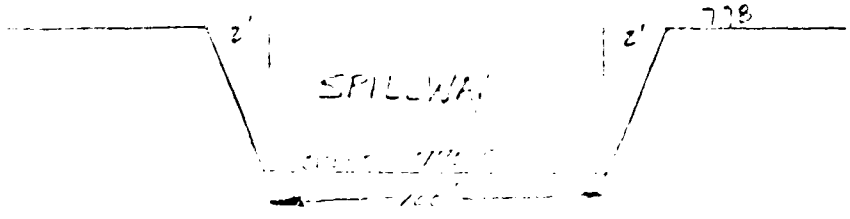
BY W.A. LEONARD SUBJECT MOUNTAIN LAKE (HAVERHILL) SHEET NO. 3 OF 4
DATE 3-13-79 STAGE-DISCHARGE CALCS JOB NO. 79-003-0

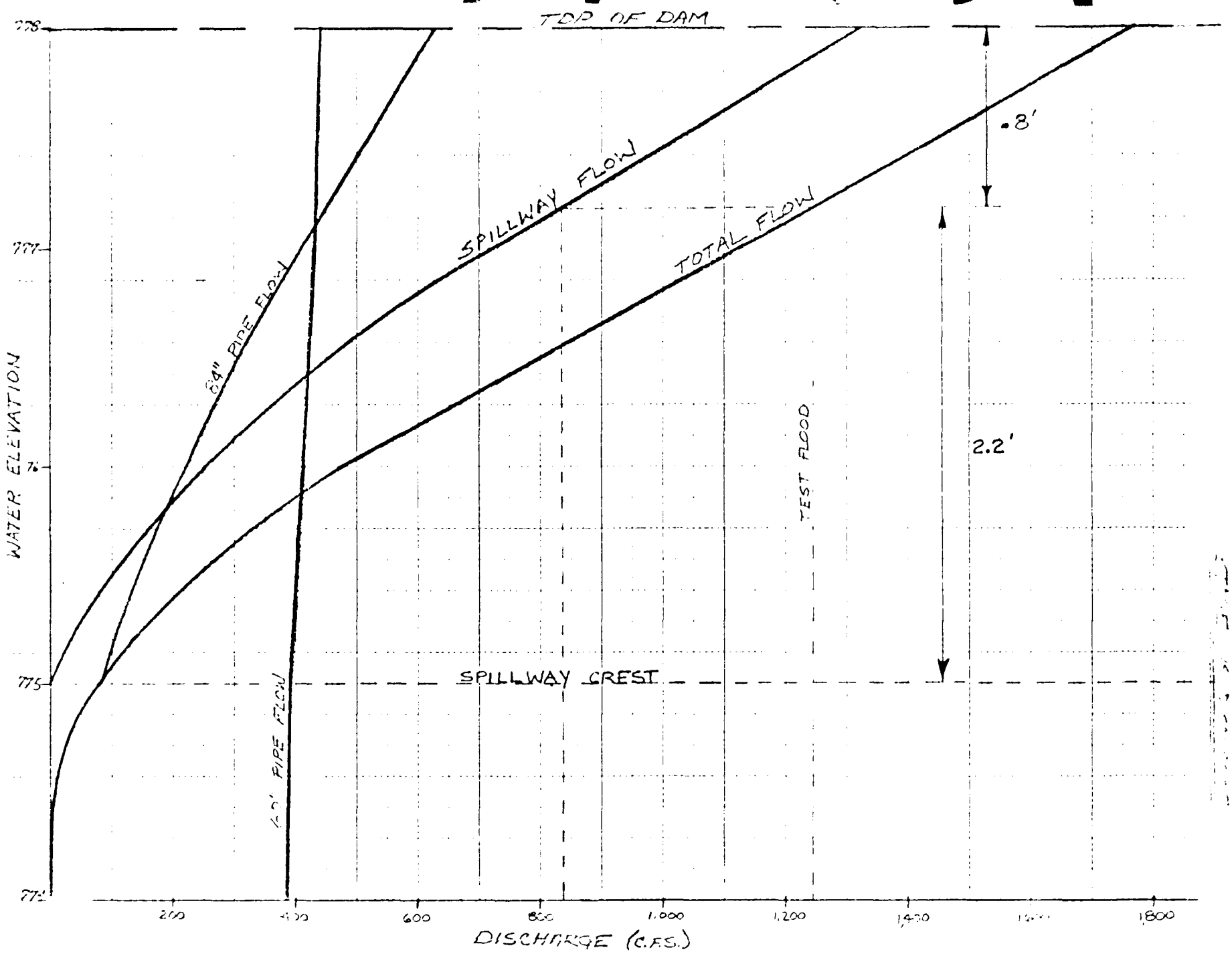
TOP OF DAM 778.0
SPILLWAY CREST 775.0
TOP OF RISER 774.0 84" DIAMETER PIPE



NOTE: FLOW INTO 84" PIPE (WEIR FLOW) CONTROLS UP TO ELEV. 777.1

El.	h(774)	Q INTO 84"	h (ABOVE 755.7)		Q INTO 60"	h	A	Q OVER SPILLWAY	Q_{TOT}
774	0	0		KH/D	0				0
775	1	73.3	19.3	3.86	390				73.3
776	2	207	20.3	4.06	410	1	100.7	252	459
777	3	381	21.3	4.26	430	2	202.7	717	1098
778	4	586	22.3	4.46	440	3	304	1325	1765



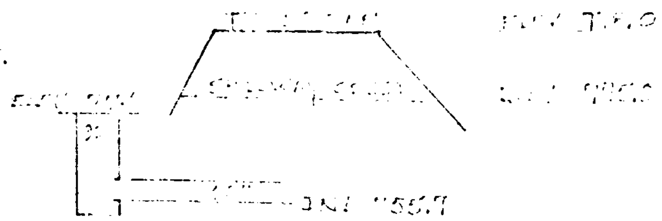

TOP OF DAM
778
777
776
775
774
WATER ELEVATION
64" PIPE FLOW
SPILLWAY FLOW
TOTAL FLOW
.8'
2.2'
TEST FLOOD
SPILLWAY CREST
42" PIPE FLOW
200
600
800
1,000
1,200
1,800
DISCHARGE (C.F.S.)

DUFRESNE-HENRY ENGINEERING CORPORATION

BY [illegible] SUBJECT [illegible] SHEET NO. [illegible] OF [illegible]
DATE [illegible] JOB NO. [illegible]

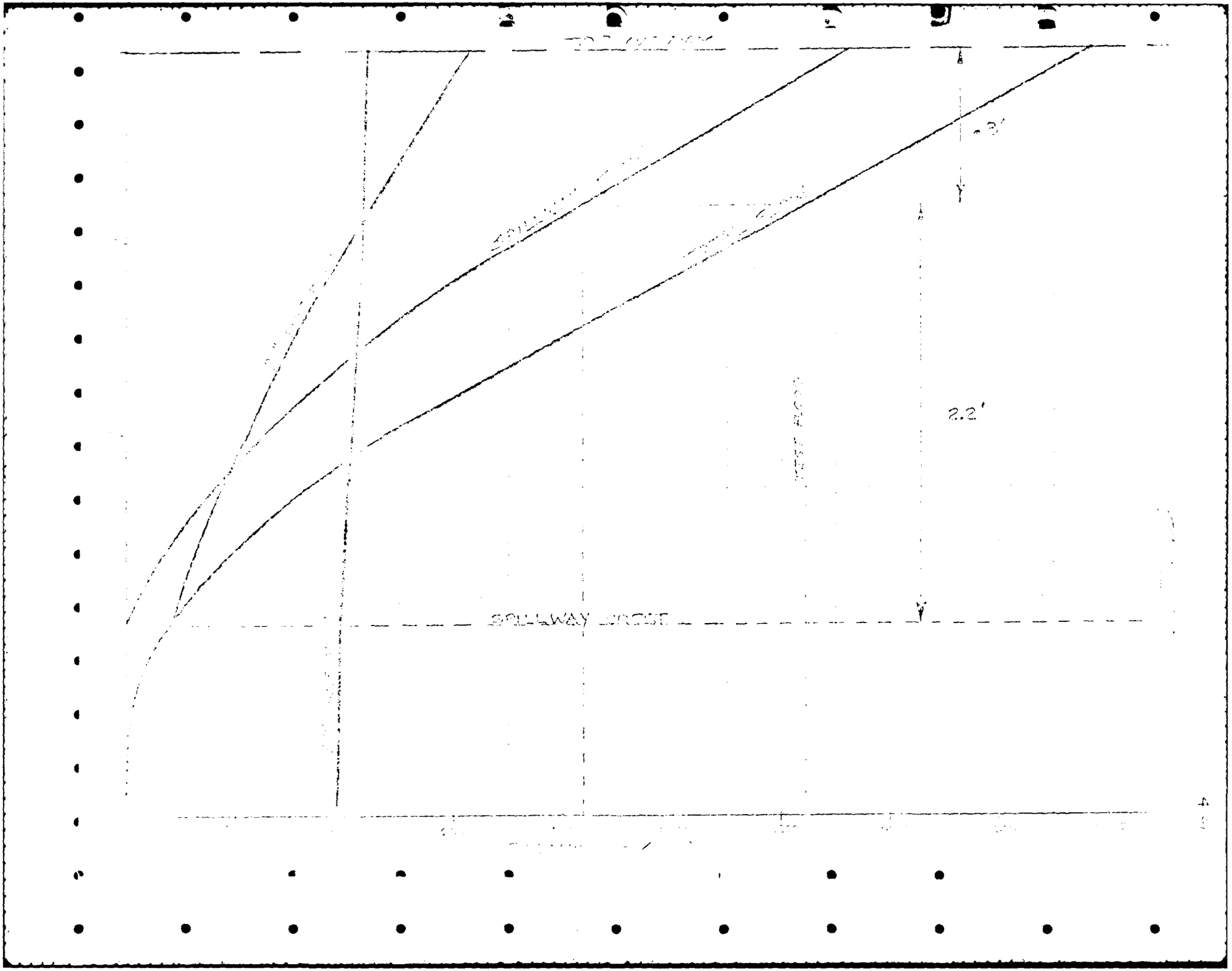
[illegible] 778.0
[illegible] 775.0
[illegible] 774.0 90" [illegible]

[illegible]



NOTE: FLOW INTO 90" PIPE (WEIR FLOW)
CONTROLS UP TO ELEV. 777.1

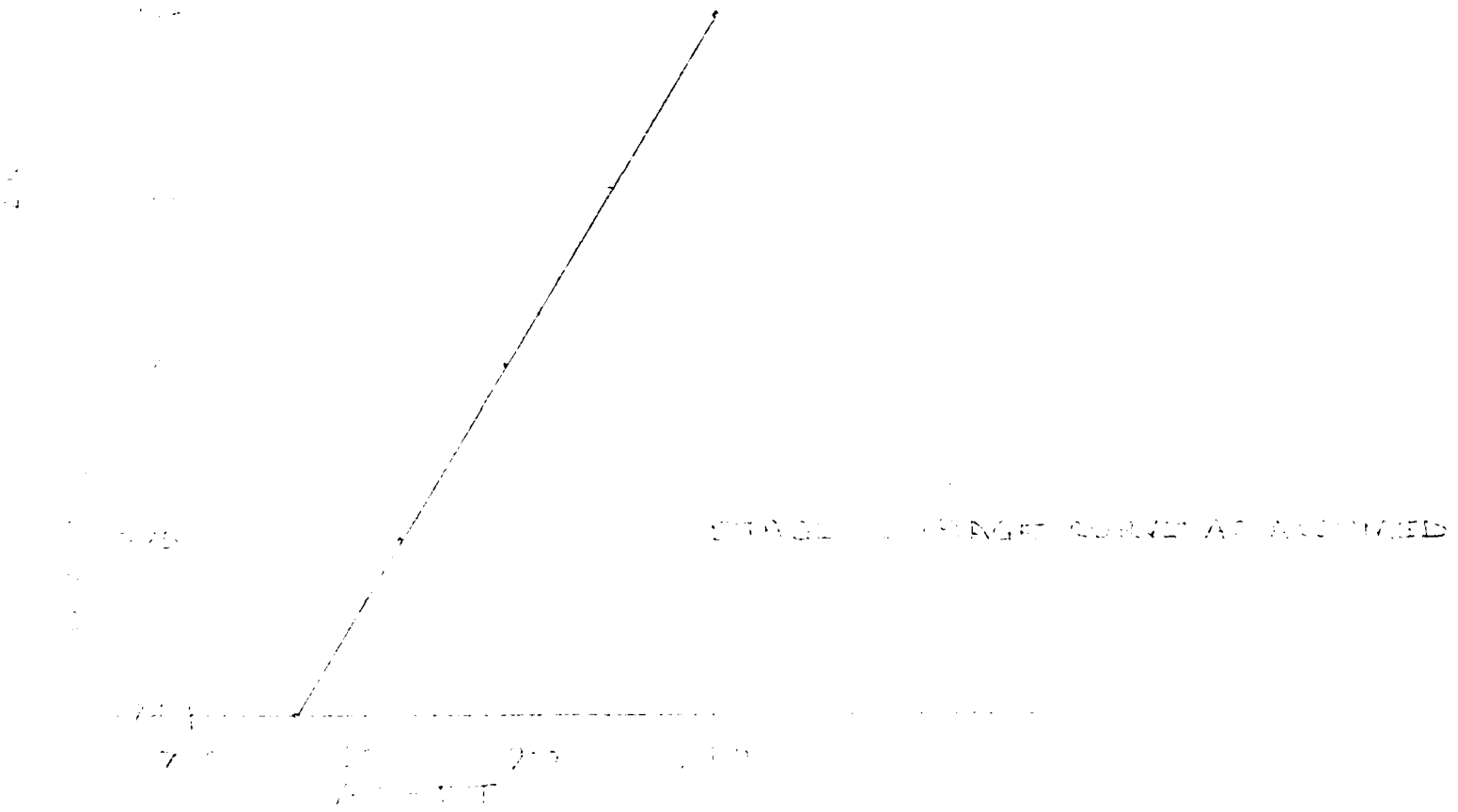
						Q		
[illegible]	1	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1	1027 [illegible]	[illegible]
777	3	[illegible]	20.3	[illegible]	430	2	2037 711	[illegible]
[illegible]	4	[illegible]	[illegible]	[illegible]	410	3	[illegible] 13.245	[illegible]


2.2'
SPILLWAY CREST

DUFFIELD-HEILY ENGINEERING CORPORATION

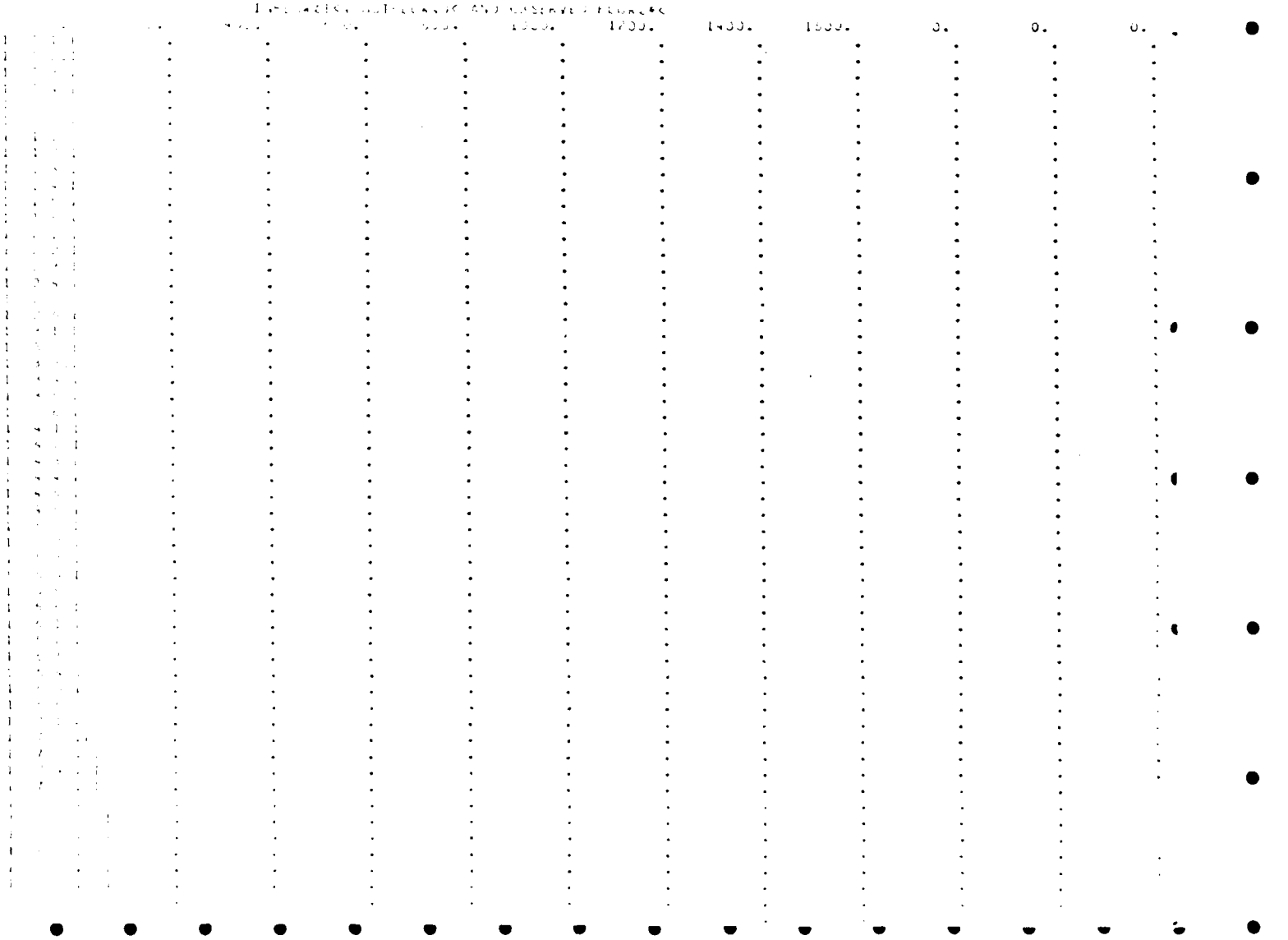
BY _____ SUBJECT _____ SHEET NO _____ OF _____

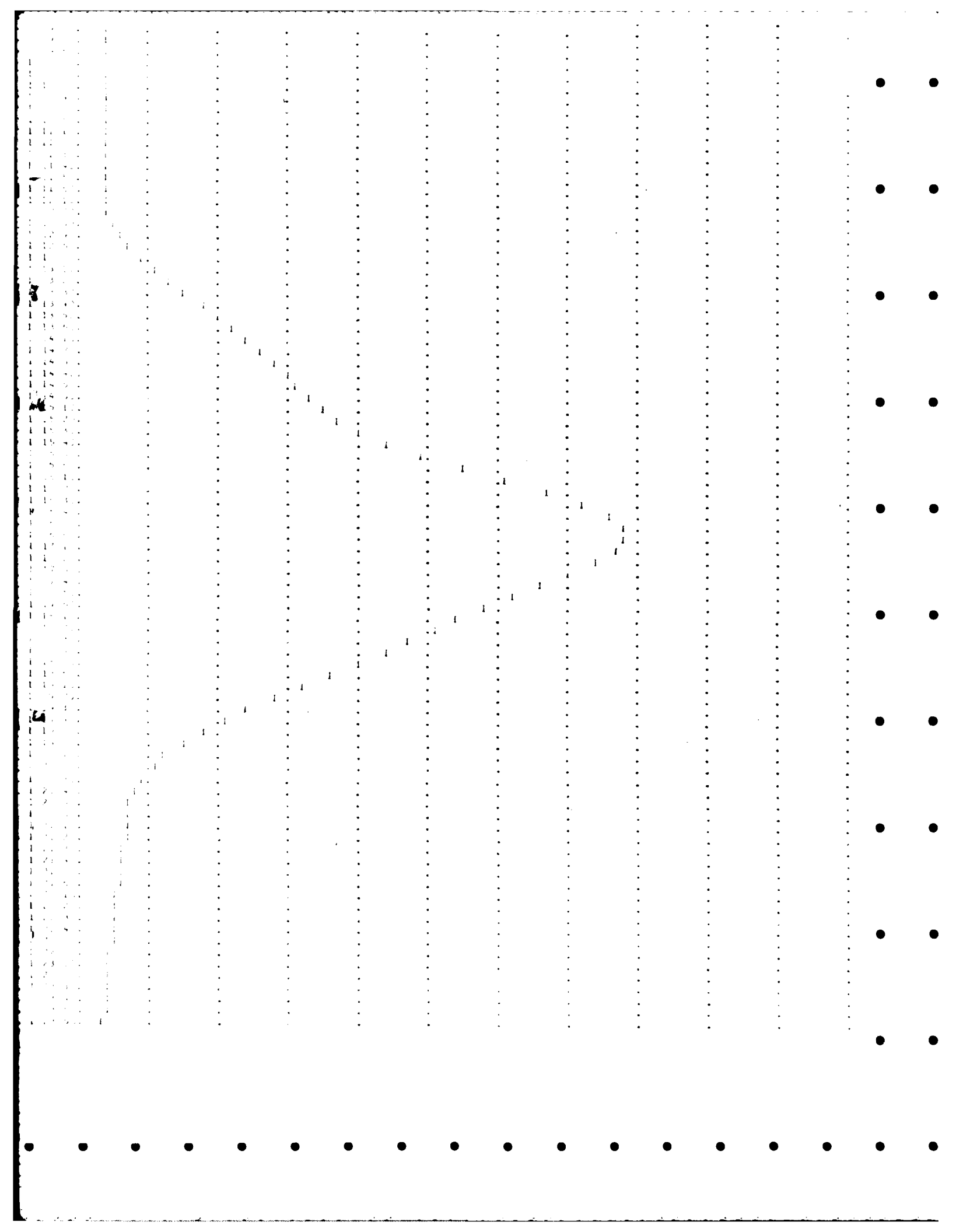
DATE _____ JOB NO _____



	PEAK				
AC-FT					

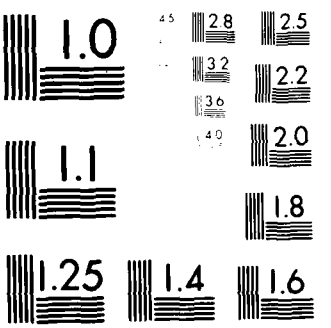
STATION 1





AD-A156 427 NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS LOWER MOUNTAIN LAKE (.. (U) CORPS OF ENGINEERS WALTHAM MA NEW ENGLAND DIV MAR 79 2/2

UNCLASSIFIED F/G 13/13 NL



MICROCOPY RESOLUTION TEST CHART

HYDROGRAPH ROUTING

RESERVOIR ROUTING FOR MOUNTAIN LAKE

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
1	1	0	0	0	0	1

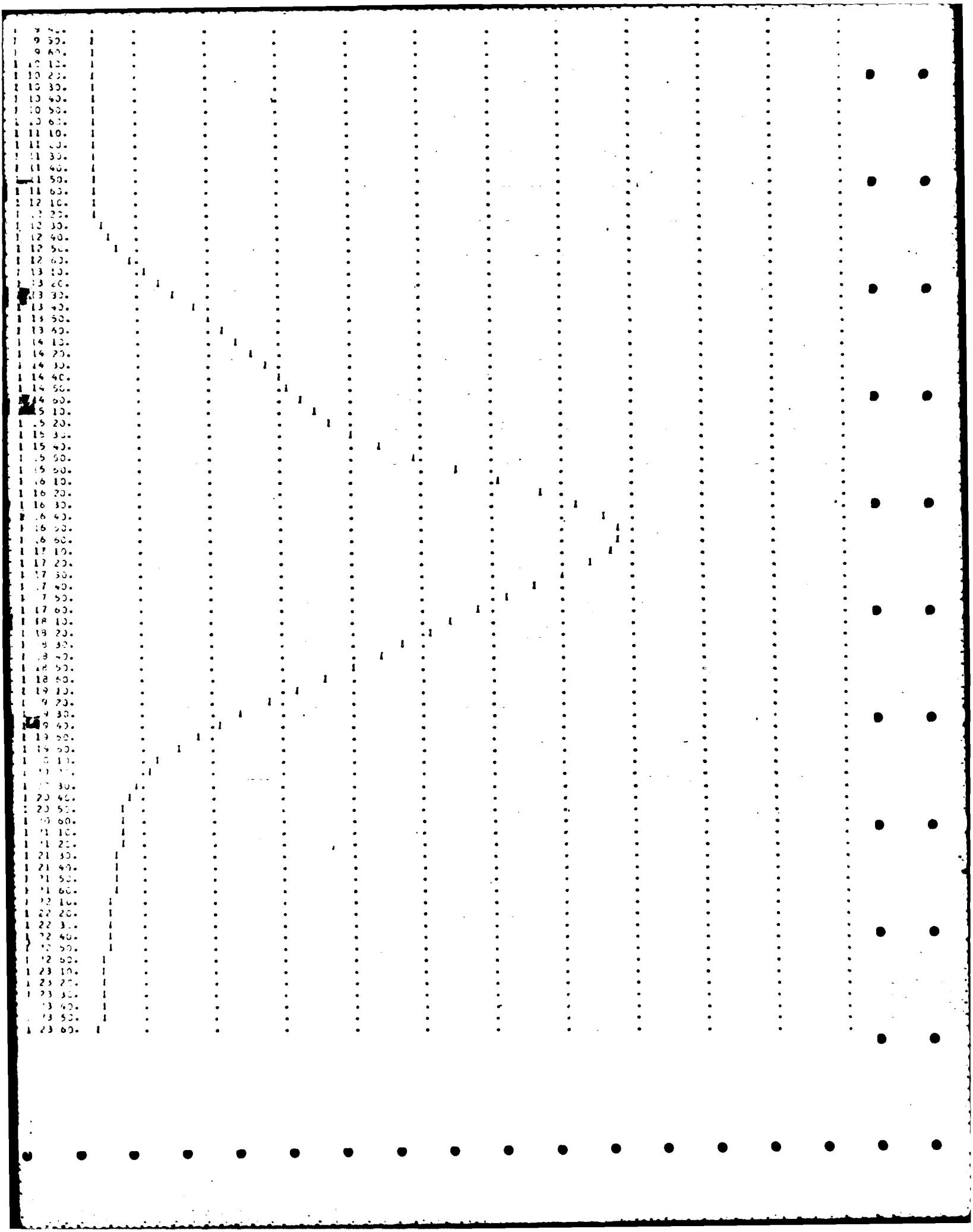
ROUTING DATA

CLOSS	CLOSS	AVG	IRES	ISAME
0.0	0.0	0.0	1	0

NSTPS	NSTOL	LAG	AMSKK	X	TSK	STORA
1	0	0	0.0	0.0	0.0	-1.

AGER	760.	820.	880.	940.	1000.	0.	0.	0.	0.	0.
ELAR	0.	77.	474.	1125.	1765.	0.	0.	0.	0.	0.

	TIME			ECP STOR	AVG IN	ECP OUT
1	0	10		761.	1.	1.
1	0	20		761.	1.	1.
1	0	30		761.	1.	1.
1	0	40		761.	1.	1.
1	0	50		761.	1.	1.
1	0	60		761.	1.	1.
1	1	10		761.	1.	1.
1	1	20		761.	1.	1.
1	1	30		761.	1.	1.
1	1	40		761.	1.	1.
1	1	50		761.	1.	1.
1	1	60		761.	1.	1.
1	2	10		761.	1.	1.
1	2	20		761.	1.	1.
1	2	30		761.	1.	1.
1	2	40		761.	1.	1.
1	2	50		761.	1.	1.
1	2	60		761.	1.	1.
1	3	10		761.	0.	1.
1	3	20		761.	0.	1.
1	3	30		761.	0.	1.
1	3	40		761.	0.	1.
1	3	50		761.	0.	1.
1	3	60		761.	0.	1.
1	4	10		761.	0.	1.
1	4	20		761.	0.	1.
1	4	30		761.	0.	1.
1	4	40		761.	0.	1.
1	4	50		761.	0.	1.
1	4	60		761.	0.	1.
1	5	10		761.	0.	1.
1	5	20		761.	0.	1.
1	5	30		761.	0.	1.
1	5	40		761.	0.	1.
1	5	50		761.	0.	1.
1	5	60		761.	0.	1.
1	6	10		761.	0.	1.
1	6	20		761.	1.	1.
1	6	30		761.	2.	1.
1	6	40		761.	5.	1.
1	6	50		761.	8.	1.
1	6	60		761.	12.	1.
1	7	10		761.	17.	1.
1	7	20		761.	23.	2.
1	7	30		762.	29.	2.
1	7	40		762.	36.	3.
1	7	50		763.	42.	4.
1	7	60		763.	47.	4.
1	8	10		764.	52.	5.
1	8	20		765.	55.	6.
1	8	30		765.	57.	7.
1	8	40		766.	61.	8.
1	8	50		767.	63.	9.
1	8	60		768.	65.	10.
1	9	10		769.	67.	11.
1	9	20		769.	68.	12.
1	9	30		770.	69.	13.
1	9	40		771.	70.	14.
1	9	50		772.	71.	15.
1	9	60		772.	72.	16.
1	10	10		773.	72.	17.
1	10	20		774.	73.	18.
1	10	30		775.	73.	19.
1	10	40		775.	73.	20.
1	10	50		776.	73.	21.
1	10	60		777.	74.	22.
1	11	10		777.	74.	23.
1	11	20		778.	74.	24.
1	11	30		779.	74.	25.
1	11	40		780.	74.	26.
1	11	50		780.	74.	
1	11	60		781.	74.	



RUNOFF MULTIPLIED BY 0.14

1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	1.	3.	6.
13.	14.	20.	26.	32.	39.	44.	49.	54.	57.
60.	62.	64.	66.	68.	69.	70.	71.	71.	72.
72.	73.	73.	73.	74.	74.	74.	74.	74.	74.
74.	74.	75.	82.	95.	115.	141.	173.	215.	259.
305.	355.	402.	446.	485.	522.	555.	583.	627.	660.
697.	734.	803.	869.	767.	1131.	1223.	1335.	1438.	1513.
1559.	1564.	1537.	1432.	1409.	1325.	1239.	1160.	1087.	1016.
945.	872.	797.	720.	641.	563.	485.	410.	351.	296.
247.	210.	176.	159.	149.	143.	137.	132.	127.	122.
117.	112.	108.	103.	99.	95.	92.	88.	84.	81.
78.	75.	72.	69.						

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1564.	940.	280.	280.	1124.
INCHES		2.33	2.33	2.33	2.33
AC-FT		466.	567.	567.	567.

DVF

STATION 1

INFLOW(I), DIFFLOW(D) AND OBSERVED FLOW(F)

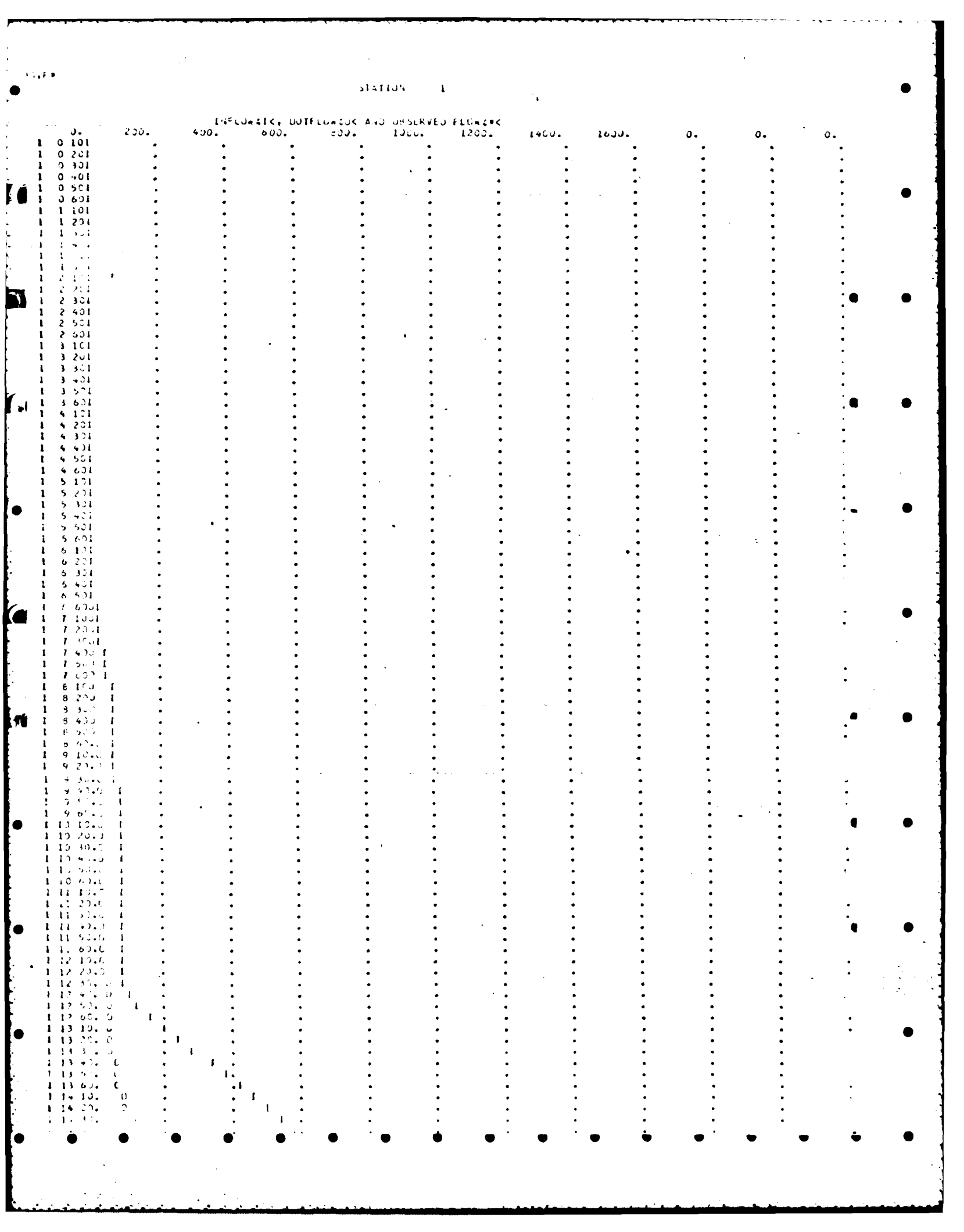
0.	2000.	4000.	6000.	8000.	10000.	12000.	0.	0.	0.	0.	0.
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	PRECIPEL< AND EXCESS*** 0.8	0.4	0.0
1 0 10I	.	.	.	.	.	.	.	.	.	.	L
1 0 20I	.	.	.	.	.	.	.	.	.	.	L
1 0 30I	.	.	.	.	.	.	.	.	.	.	L
1 0 40I	.	.	.	.	.	.	.	.	.	.	L
1 0 50I	.	.	.	.	.	.	.	.	.	.	L
1 0 60I	.	.	.	.	.	.	.	.	.	.	L
1 1 10I	.	.	.	.	.	.	.	.	.	.	L
1 1 20I	.	.	.	.	.	.	.	.	.	.	L
1 1 30I	.	.	.	.	.	.	.	.	.	.	L
1 1 40I	.	.	.	.	.	.	.	.	.	.	L
1 1 50I	.	.	.	.	.	.	.	.	.	.	L
1 1 60I	.	.	.	.	.	.	.	.	.	.	L
1 2 10I	.	.	.	.	.	.	.	.	.	.	L
1 2 20I	.	.	.	.	.	.	.	.	.	.	L
1 2 30I	.	.	.	.	.	.	.	.	.	.	L
1 2 40I	.	.	.	.	.	.	.	.	.	.	L
1 2 50I	.	.	.	.	.	.	.	.	.	.	L
1 2 60I	.	.	.	.	.	.	.	.	.	.	L
1 3 10I	.	.	.	.	.	.	.	.	.	.	L
1 3 20I	.	.	.	.	.	.	.	.	.	.	L
1 3 30I	.	.	.	.	.	.	.	.	.	.	L
1 3 40I	.	.	.	.	.	.	.	.	.	.	L
1 3 50I	.	.	.	.	.	.	.	.	.	.	L
1 3 60I	.	.	.	.	.	.	.	.	.	.	L
1 4 10I	.	.	.	.	.	.	.	.	.	.	L
1 4 20I	.	.	.	.	.	.	.	.	.	.	L
1 4 30I	.	.	.	.	.	.	.	.	.	.	L
1 4 40I	.	.	.	.	.	.	.	.	.	.	L
1 4 50I	.	.	.	.	.	.	.	.	.	.	L
1 4 60I	.	.	.	.	.	.	.	.	.	.	L
1 5 10I	.	.	.	.	.	.	.	.	.	.	L
1 5 20I	.	.	.	.	.	.	.	.	.	.	L
1 5 30I	.	.	.	.	.	.	.	.	.	.	L
1 5 40I	.	.	.	.	.	.	.	.	.	.	L
1 5 50I	.	.	.	.	.	.	.	.	.	.	L
1 5 60I	.	.	.	.	.	.	.	.	.	.	L
1 6 10I	.	.	.	.	.	.	.	.	.	.	L
1 6 20I	.	.	.	.	.	.	.	.	.	.	L
1 6 30I	.	.	.	.	.	.	.	.	.	.	LA
1 6 40I	.	.	.	.	.	.	.	.	.	.	LR
1 6 50I	.	.	.	.	.	.	.	.	.	.	LR
1 6 60I	.	.	.	.	.	.	.	.	.	.	L
1 7 10I	.	.	.	.	.	.	.	.	.	.	L
1 7 20I	.	.	.	.	.	.	.	.	.	.	L
1 7 30I	.	.	.	.	.	.	.	.	.	.	LR
1 7 40I	.	.	.	.	.	.	.	.	.	.	LR
1 7 50I	.	.	.	.	.	.	.	.	.	.	L
1 7 60I	.	.	.	.	.	.	.	.	.	.	L
1 8 10I	.	.	.	.	.	.	.	.	.	.	LA
1 8 20I	.	.	.	.	.	.	.	.	.	.	LR
1 8 30I	.	.	.	.	.	.	.	.	.	.	L

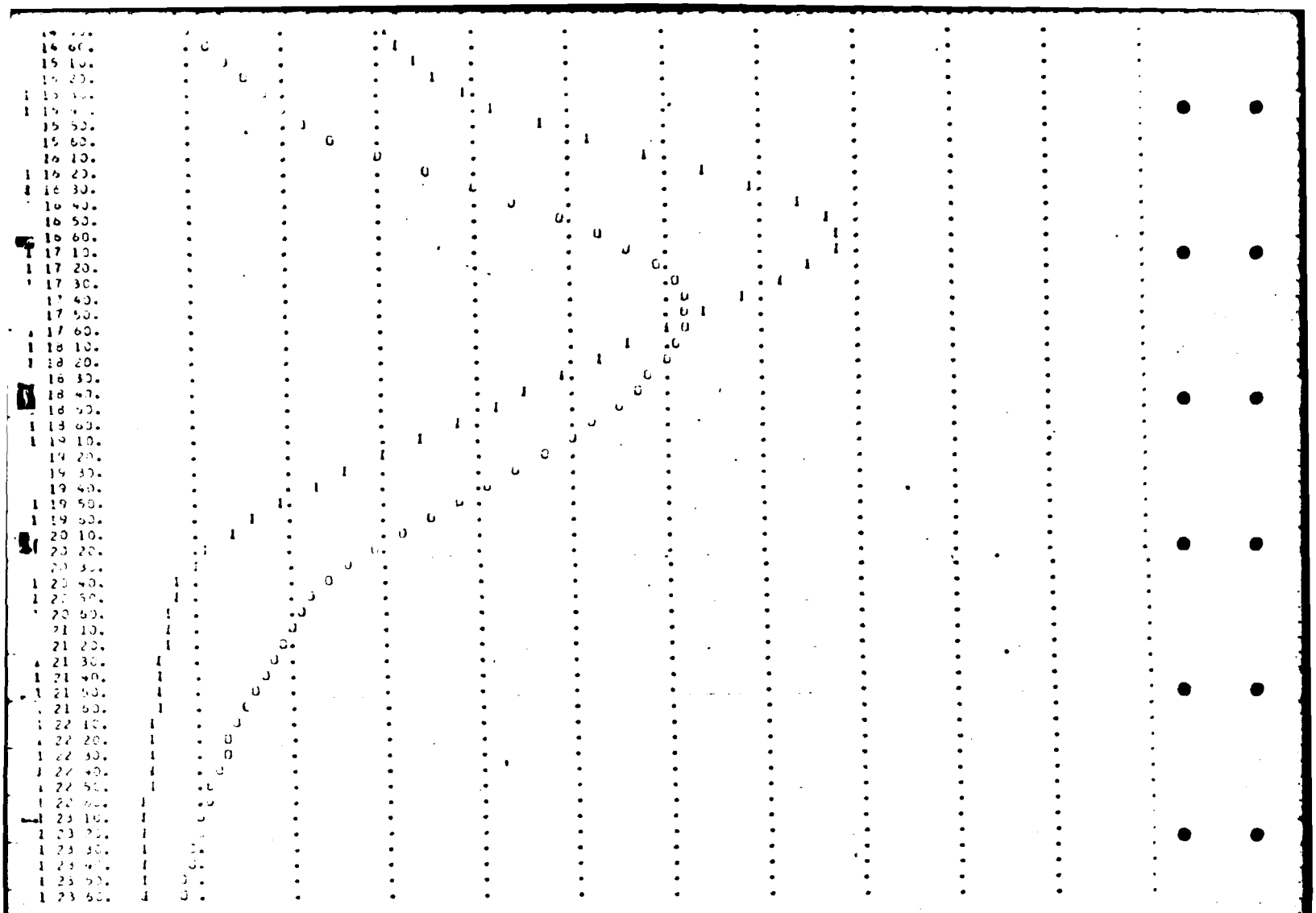
1	12	20	802.	79.	29.
1	12	30	799.	84.	30.
1	12	40	794.	139.	51.
1	12	50	790.	147.	53.
1	12	60	787.	159.	55.
1	13	10	784.	199.	38.
1	13	20	782.	237.	42.
1	13	30	779.	283.	46.
1	13	40	799.	331.	51.
1	13	50	834.	379.	57.
1	13	60	869.	424.	64.
1	14	10	814.	495.	71.
1	14	20	823.	504.	79.
1	14	30	825.	540.	119.
1	14	40	832.	576.	156.
1	14	50	838.	610.	196.
1	14	60	844.	644.	236.
1	15	10	850.	678.	275.
1	15	20	856.	720.	313.
1	15	30	862.	776.	354.
1	15	40	868.	848.	397.
1	15	50	875.	938.	444.
1	15	60	883.	1044.	509.
1	16	10	892.	1162.	600.
1	16	20	900.	1283.	694.
1	16	30	907.	1388.	791.
1	16	40	916.	1478.	888.
1	16	50	926.	1538.	976.
1	16	60	934.	1561.	1058.
1	17	10	940.	1551.	1126.
1	17	20	945.	1509.	1179.
1	17	30	949.	1446.	1215.
1	17	40	952.	1367.	1236.
1	17	50	951.	1282.	1242.
1	17	60	950.	1199.	1236.
1	18	10	949.	1123.	1221.
1	18	20	947.	1051.	1198.
1	18	30	944.	981.	1166.
1	18	40	941.	909.	1132.
1	18	50	937.	834.	1091.
1	18	60	933.	758.	1045.
1	19	10	928.	680.	994.
1	19	20	923.	602.	940.
1	19	30	918.	525.	882.
1	19	40	912.	452.	822.
1	19	50	906.	384.	761.
1	19	60	901.	323.	700.
1	20	10	895.	272.	641.
1	20	20	890.	230.	584.
1	20	30	885.	194.	529.
1	20	40	880.	167.	479.
1	20	50	876.	152.	444.
1	20	60	872.	140.	422.
1	21	10	868.	140.	398.
1	21	20	865.	135.	375.
1	21	30	862.	129.	354.
1	21	40	859.	124.	334.
1	21	50	856.	119.	315.
1	21	60	853.	114.	298.
1	22	10	851.	110.	281.
1	22	20	848.	106.	266.
1	22	30	846.	101.	252.
1	22	40	844.	97.	238.
1	22	50	842.	93.	226.
1	22	60	841.	90.	214.
1	23	10	839.	86.	203.
1	23	20	837.	83.	192.
1	23	30	836.	79.	183.
1	23	40	834.	76.	173.
1	23	50	833.	73.	165.
1	23	60	832.	70.	157.
		SUM			36007.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1242.	827.	250.	250.	36037.
INCHES		2.05	2.47	2.47	2.47
ACRE-FT		410.	496.	496.	496.

STATION 1

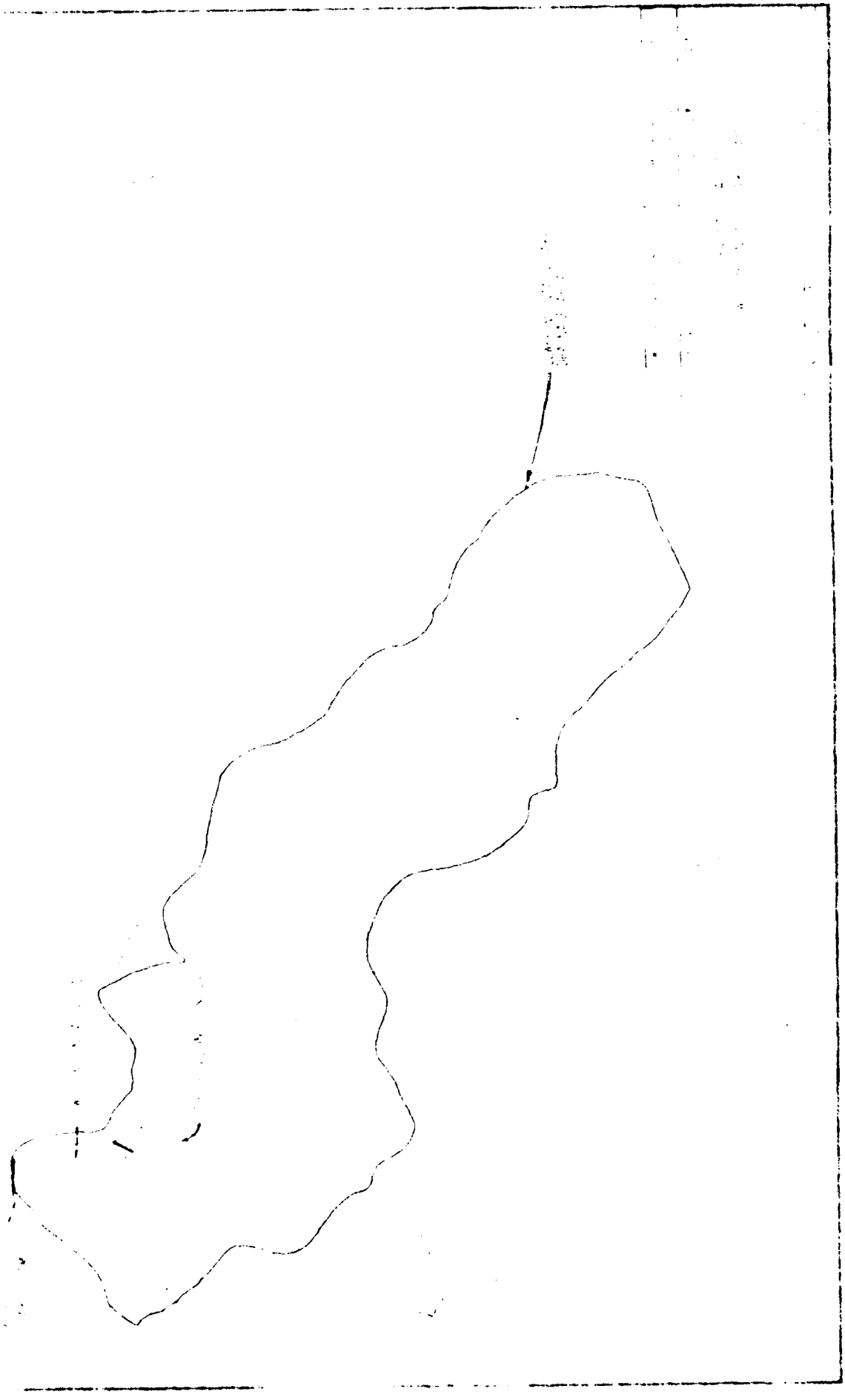
INFLOW=I<, OUTFLOW=O< AND OBSERVED FLOW=*<





RUNOFF SUMMARY, AVERAGE FLOW

		PEAK	6-HOUR	24-HOUR	72-HOUR	AREA
[illegible] AT	1	1504.	944.	[illegible]	230.	3.76
[illegible]	1	1492.	827.	250.	250.	3.76



APPENDIX E

Information as Contained in the National Inventory of Dams

INVENTORY OF DAMS IN THE UNITED STATES

NAME	LATITUDE (NORTH)	LONGITUDE (WEST)	REPORT DATE DAY MO YR
	447.1	7157.4	20DEC78

STATE NAME	NAME OF IMPOUNDMENT
	[illegible] LAKE

NEAREST DOWNSTREAM CITY TOWN-VILLAGE	DIST FROM DAM (MI)	POPULATION
[illegible] VILLE	0	5040

PURPOSES	YEAR COMPLETED	DAM HEIGHT (FT)	LENGTH (FT)	DIST	DAM	FED R	PRV/FED	SCS A	YEAR/DATE
[illegible]	[illegible]	1	760	NED	N	N	N	N	

REMARKS

HYDRAULIC CAPACITY	NAVIGATION LOCKS				
	LENGTH (FT)	WIDTH (FT)	LENGTH (FT)	WIDTH (FT)	

ENGINEERED BY	CONSTRUCTION BY
[illegible]	[illegible] CONSTRUCTION

REGULATORY AGENCY	OPERATION	MAINTENANCE
[illegible]	[illegible]	[illegible]

INSPECTED BY	INSPECTION DATE DAY MO YR	AUTHORITY FOR INSPECTION
[illegible]	[illegible]	PL [illegible] 567

REMARKS

END

FILMED

8-85

DTIC